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PATENT OFFICE

THE

PREFACE.

W*RITING and PLOUGHING are two different Talents; and he that writes well, muſt have ſpent in his* Study *that Time, which is neceſſary to be ſpent in the* Fields, *by him who will be Maſter of the Art of Cultivating them.*

To write then effectually of Ploughing, *one muſt not be qualified to write* Learnedly.

Scarce any Subject has had more of the Ornaments of Learning beſtowed on it, than Agriculture *has, by antient and modern Writers: But a late Great Man, who was the* Cicero *of the Age, having peruſed all their Books of Husbandry, ordered them, notwithſtanding their Eloquence, to be carried upon a Hand-Barrow out of his Study, and thrown into the Fire; leſt others ſhould loſe their Time in Reading them, as he had done. He declared, he could not, for his Life, gueſs what thoſe Authors would be at; for they treated of an Art, wherein they had formed no manner of Principles.*

Now if theſe learned Volumes, ſo elegantly written, and ſo little to the Purpoſe, have done nothing but Miſchief; 'tis Time that ſomething ſhould be writ different from them, in both Reſpects.

How far I am capable of performing ſuch a Taſk in one of theſe Reſpects, this Part of my Eſſay will ſhew; but what I have done different from them in the other of the two Reſpects, cannot be fairly judged of, before the Whole appears: And becauſe ſome Circumſtances make it uncertain, whether ever it may all appear publickly, I give a ſhort Account of it now.

The Deſign of the Whole is, to increaſe the Profit of Land, by introducing a ſort of Vineyard-Culture *into the Fields.*

'Tis founded upon Principles, which if they be true, (for I can only ſay I think them ſo) they muſt be, as all Truth is, Eternal; and yet are not extant in any Author, that I can find, or hear of.

Theſe Principles I have compriſed under the following Heads, or Chapters.

I. Of Roots.
II. Of Leaves.
III. Of the Food of Plants.
IV. Of the Paſture of Plants.
V. Of Dung.
VI. Of Tillage.
VII. Of Houghing.
VIII. Of Weeds.
IX. Remarks on the bad Husbandry that is ſo finely expreſs'd in *Virgil*'s firſt *Georgic*.
X. Of Drilling and Managing of Turnips, and ſuch like Crops in the Fields for feeding of Cattle.
XI. Of Drilling and Houghing of Wheat.
XII. Of Smuttineſs of Wheat.
XIII. Of the Blight of Wheat.
XIV. Of Drilling and Managing of St. *Foin*, and of every Thing that may concern it.
XV. Of Luſerne.

And theſe,

I. Of Change of Species.
II. Of Change of Individuals.

III. Of

BRITISH MUSEUM

III. Of Ridges.
IV. Of Ploughs.
V. Of ſome Differences between the Old and the New Husbandry.

The firſt Nine Chapters conſiſt of Experiments, Obſervations, *and* Arguments *to prove thoſe Principles in Theory, which ſeem to ſolve all the* Phænomena *of* Vegetation *neceſſary to be known in* Agriculture.

The next Six Chapters ſhew how theſe Principles are to be put in Practice; for however plauſible they might appear in their Speculative View, I ſhould have rejected them on account of their Novelty, If I had not ſeen the Truth of them fully demonſtrated in the Field.

Moſt of what is ſaid in the firſt of theſe Five (now preſented to the Reader) concerning Change of Species, *might have been inferr'd from ſome of the Arguments in the Chapter of* Weeds; *but becauſe the mere* ipſe dixit *of Doctor* Woodward, *ſeems to have been of ſufficient Strength to draw after him Mr.* Bradley, *Mr.* Mortimer, *and I know not how many other Writers, into his Opinion; I thought it neceſſary to be more full in Arguments againſt it; it being of ill Conſequence to the* Old Husbandry, *by encouraging the Sloth of Farmers to neglect the due Tillage of their Land for killing of* Weeds; *and would render uſeleſs that Part of our* New Husbandry *which deſtroys all* Weeds; *beſides another great Advantage his Opinion would take from us; that is, when we have found a Species of Vegetables that ſuits the Degrees of Heat and Moiſture (which may be call'd the* Climate) *of a Soil; and whoſe Produce alſo ſuits beſt our Markets; we muſt, after one or two Crops, change it for a different Species, which ſuits neither our Soil or Markets ſo well, if we believe that every Species takes only a ſpecifick Nouriſhment which is proper to that Species alone.*

Some Arguments that are but light, may weigh more with ſome People than others of greater Weight; and a common Farmer may reject a falſe Opinion ſooner, when *he ſees it ſhewn to be ridiculous, than for the ſtrongeſt Argument that could be brought againſt it.*

I muſt prevent an Objection that may perhaps be brought againſt me, for ſaying, that all the Species of Plants that have been yet try'd by our Houghing Husbandry, *grow every Year better without Changing. They may alledge, that our Intervals kept from being exhauſted, afford every Year a Change of Soil, but, in Truth, they were planted in narrower Intervals than we uſe at preſent, and none of the Earth kept from the Roots, they all before their Maturity, being ſuffered to ſend out their Roots quite through the Intervals; yet when they had much Paſture raiſed by the Hough, and were robbed of none of it by Weeds, there ſtill remained ſufficient Paſture for another Crop of the ſame Species to ſucceed it the next Year: And I have at this Time, in ſuch Intervals, a Fifth annual ſucceſſive Crop of Wheat, without intermitting any Year, and without Aſſiſtance of Dung or Manure, that is ſtronger than any one of the four preceding Crops, or than any Wheat in all the Neighbourhood is.*

A late Author adviſes, that Dr. Woodward *of* Vegetation, *be inſerted in every Treatiſe of* Agriculture, *and I muſt adviſe the Reader to peruſe him at large; becauſe I have, by Miſtake, omitted to inſert ſome Part which I have anſwered; and becauſe another material Part which I have anſwered and inſerted, is omitted in Mr.* Lowthorp*'s Abridgment.*

Change *of* Individuals, *is when we change our Seed; but not the Species of our Crop. What relates particularly to the changing of Seed-Wheat, is, I hope, fully treated of in the Chapter of* Smuttineſs, *which is too long to be here repeated.*

I have had a wet ſpewy Hill of my own made dry, by only ploughing the Ridges croſs its Deſcent, inſtead of ploughing them up and down; but whether a Hill be worth more than the Ground-Plot it ſtands on, does not concern me; therefore I ſhould have ſaid nothing a-

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bout it, if Mr. Bradley*'s Arguments thereupon had not ſeem'd to interfere with Part of my* Theory.

Under the Title of Ploughs, *I intended to have placed the Deſcriptions of all my particular Inſtruments of* Agriculture; *eſpecially of the Drill, whereon this Huſbandry depends, and is impracticable without it. I ſhould not trouble the* Reader *with an Account how accidentally it was diſcovered, were it not to ſhew, that the Knowledge of a Thing which ſeems deſpicable or impertinent, may unexpectedly become uſeful at one time or other.*

When I was Young, my Diverſion was Muſick: *I had alſo the Curioſity to acquaint my ſelf throughly with the Fabrick of every Part of my* Organ; *but as little thinking that ever I ſhould take from thence, the firſt* Rudiments *of a* Drill, *as that I ſhould ever have occaſion of ſuch a Machine, or practice* Agriculture; *for 'twas Accident, not Choice, that made me a Farmer, or rather many Accidents which could not then poſſibly be foreſeen.*

It was my Chance afterwards to have a large Farm in Hand, which I could not well diſpoſe of; and it being about the Time, when Plough-Servants firſt began to exalt their Dominion over their Maſters, ſo that a Gentleman-Farmer was allowed to make but little Profit of his Arable Lands; and almoſt all mine being of that Sort, I reſolved to plant my whole Farm with St. Foin; *but the Seed of it being ſcarce, and dear, and very little of it good, I found it would be difficult to procure a ſufficient Quantity to ſow, at ſeven Buſhels to each Acre, which were uſually ſown: Whereupon I began to examine whether ſo great a Quantity of Seed was abſolutely neceſſary; and whether the greateſt Part of the Seed ſown, did not commonly miſcarry, either by its Badneſs, or from being buried too deep, or elſe lying on the Ground uncovered: And I obſerved in ſeveral* Fields *of St.* Foin, *ſown with that Proportion of Seed, that in thoſe Parts of them, which produced the beſt Crop, there were (as I* *counted them, when the Crop was taken off) but about one Plant for each ſquare Foot of Surface; and yet the Number of Seeds in ſeven Buſhels ſown on each Acre, being calculated, amounted to One Hundred and Forty to each ſquare Foot; and what was yet more obſervable, in other Parts of the ſame Fields, where a much leſs Number of Seeds had miſcarried, the Crop was leſs. Then after I had learn'd perfectly how to diſtinguiſh good Seeds from bad, and had, by many Trials, found, that ſcarce any, even of the beſt, would ſucceed, unleſs covered at a certain exact Depth (eſpecially in my ſtrong Land) and had alſo found the Reaſon of this Nicety, I employ'd People to make Channels, and ſow a very ſmall Proportion of Seed therein, and cover it exactly.*

This Way ſucceeded to my Deſire, and was in Seed and Labour but a fourth Part of the Expence of the common Way, and yet the Ground was better planted.

Ten Acres being ſo well done, I did not doubt but a Thouſand might have been as well done in the ſame manner; but the next Year, as ſoon as I began to plant, I diſcover'd, that theſe People had conſpir'd to diſappoint me, for the future, and never to plant a Row tolerably well again; perhaps jealous, that if a great Quantity of Land ſhould be taken from the Plough, it might prove a Diminution of their Power; I was forc'd to diſmiſs my Labourers, reſolving to quit my Scheme, unleſs I could contrive an Engine to plant St. Foin *more faithfully than ſuch Hands would do.*

To that Purpoſe I examin'd and compar'd all the mechanical Ideas that ever had enter'd my Imagination, and at laſt pitch'd upon a Groove, Tongue, and Spring in the Sound-Board of the Organ: With theſe, a little alter'd, and ſome Parts of two other Inſtruments as foreign to the Field as the Organ is, added to them, I compos'd my Machine: 'Twas nam'd a Drill; *becauſe when Farmers us'd to ſow their Beans and Peas into Channels or Furrows, by Hand, they call'd that Action,* Drilling.

It planted that Farm much better than Hands could have done, and many hundred Acres beſides; and thirty Years Experience ſhews, that St. Foin *thus planted, brings better Crops, and laſteth longer than ſown* St. Foin.

This Drill *has alſo been us'd almoſt as long in planting moſt Sorts of Corn for Hand-Houghing; and theſe laſt nine Years for Horſe-Houghing.*

The Hough-Plough was alſo intended to have been deſcrib'd here; it ploughs as deep, and as well as a common Plough, and differs but little from it; except that this has Shafts or Thills inſtead of Wheels, and is ſo contriv'd, that the Cattle that draw it, may not tread upon the Rows, when they plough betwixt them.

The four-coulter'd Plough is very uſeful in the Old Husbandry; *and in preparing of Land for this: I was writing Directions how to make it; but when I found they would be imperfect without Cuts, I laid them by; becauſe I did not think it reaſonable to be at ſuch an Expence, on the Account of that, which is only an Improvement of a common two-wheel'd Plough, before I had deſcrib'd the* Drill, *which is an Original of my own.*

However, I have taught three Plough-wrights to make theſe four-coulter'd Ploughs; and tho' two of them be dead, the Survivour is ſo perfect a Workman, that of all he has made, not one has fail'd to perform well; at leaſt, I am inform'd ſo.

And, I believe, a good Workman, who can make a two-wheel'd Plough to go well with one Coulter (which few can) may make this, having another by him for a Patern.

Four Things wherein the Profit of Agriculture *doth principally conſiſt, I thought proper to mention; becauſe few People take notice of any more than one of them.*

The cheapeſt Tillage is (I ſuppoſe) allow'd to be that done by Oxen; *eſpecially ſince Servants have had the Liberty of robbing Barns to ſurfeit Horſes with two much*

Corn, and to kill them too, when they have a Mind to puniſh their Maſter's Diſobedience.

We may now keep Oxen on almoſt any incloſ'd Farm; for we can at a very ſmall Expence, by our ſort of Houghing, raiſe as good Cabbages and Carrots in the Field, as uſ'd to grow in the Garden; and with theſe and Turnips, Oxen will live all the Year without the Help of Meadow or Paſture Ground.

It may ſeem abſurd to call our Husbandry by the Name of Horſe-Houghing, *when 'tis all perform'd by* Oxen; *but the Truth is, it had acquir'd that Name, before 'twas known, that Oxen were capable of performing it.*

They who think the Fields can have no Advantage from being planted in Rows, would do well to try if they can perſuade the Gardeners to ſet their Plants irregularly, and to ſow all their Seeds at Random.

For my Part, if I knew any ſubſtantial Objection againſt this Husbandry *it ſelf, I would not conceal it; but I declare, I know of none ſuch; Yet, I know, there are many Objections againſt its being practiſed by thoſe who do not underſtand it, therefore I have never adviſed them to attempt it; but I have diſſuaded them, as much as I could, againſt Drilling great Quantities of Wheat, before their own Practice, in ſmall Pieces, have made them perfect in this Method, by having the Principles which are neceſſary to direct them in it; for as Wheat is generally the moſt profitable Crop, ſo it requires the greateſt Circumſpection in the Management.*

For ſome other Crops, ſuch Directions might be given, that would require no more but Faith to execute them; but ſo many various Circumſtances uſually occur in the long time that Wheat ought to live, that, I think, one can give no bare Directions in them all, before they happen, but what may endanger the deceiving of the Perſon they are intended to ſerve, unleſs the Principles themſelves accompany thoſe Directions.

Some, perhaps, may ſuppoſe theſe Principles to be very numerous and prolix, becauſe they cannot be written as *eaſily as Directions which reſult from them; though, in Truth, they are not ſo, for a few Lines would contain them all, if they had received the Approbation of proper Judges: In the mean time, they are either ſo New or Paradoxical, that I cannot, without great Reluctancy, write any of them ſeparately from the Arguments I bring to ſupport them; and no Man can judge ſo impartially in his own Cauſe, or of his own Arguments, as another, who is unconcerned, may. However, when they are publiſhed, every Farmer, that approves them, makes them his own; and then, whether he uſes or abuſes them, he cannot, I hope, juſtly blame me for his Conduct.*

'Tis objected, that this Husbandry *cannot be common, by reaſon the Inſtruments, on which it depends, are heavy and troubleſome to carry to a far Diſtance, and very few Workmen know how to make them; and therefore we muſt not only ſubmit to ſuch Price as their Conſcience will ſet upon them, but alſo diſpenſe with their Miſtakes, if they be not fatal ones, or let the* Drill *alone, or teach new Workmen; for, 'tis ſaid, that no other, without the Rules, can make one good* Drill *by another, tho' every one is poſitive he can; but when he has done his utmoſt, to imitate, or (as he thinks) to improve it, 'tis (in all that I can hear of, made by ſuch Workmen) good for nothing.*

This Objection will be removed, when the Drill, *with its Appurtenances, ſhall be fully deſcribed in Cuts, well explained by a ſhort Treatiſe, ſhewing the Manner of Making and Uſing it. Then the Breſs-work, which is neceſſary only to thoſe who do not underſtand the* Drill, *being made in Box Wood, inſtead of Braſs, as it was for above twenty Years, this Inſtrument might be had in any Place, at a very ſmall Price. This I ſhould have done ere now, in order to prevent the Deceit of Pretenders; but conſidering how imperfectly moſt Engines are deſcrib'd, I reſolved to deſcribe the* Drill *effectually, or not at all: For which Purpoſe, a more than ordinary Number of Cuts are neceſſary, to ſhew every Part in all* *its Views; and Drawing and Engraving being very Chargeable, eſpecially to one who lives far from* London, *I found the End of my Labour would be to take off an Expence from others, and to lay a greater upon myſelf; and therefore I deſiſted from finiſhing what I had begun, deferring it to ſome better Opportunity.*

As to the Objection concerning the Wickedneſs of Servants and Labourers in Husbandry, *of Hedge-Breakers, and of the Takers away of our Corn at Harveſt, and other Product of our Land and Labour, tho' it be a Wickedneſs never heard of in any other Age or Country, it ought not to be objected againſt our* Husbandry *in particular; unleſs it did affect that alone.*

What I moſt apprehend, is, the Raſhneſs of thoſe who ſhall enter upon the Practice of Drilling Wheat, before they are ſufficiently inform'd concerning it; for they cannot avoid being liable to many Errors. They may drill it amongſt Couch-Graſs, or other perennial Weeds, which cannot be extracted from the Rows of Wheat, though they may eaſily be taken from Rows of Turnips, and ſuch like Crops.

They may Drill their Wheat on Land, that is full fraught with the Seeds of Poppy, and other annual Weeds that may be pull'd out of the Rows, and yet they may neglect to do it, and ſuffer them to ripen, which muſt occaſion the Loſs of two Wheat Crops, by ſaving the Expence of about one or two Shillings per *Acre; which is, in Farmer's Phraſe, no better,* Than loſing a Sheep for want of a Half-penny-worth of Tar.

They may drill it at unſeaſonable Times, as in the Froſt of Winter; and then the Rooks will have a fair Chance, to come in for the greateſt Part of it, and the reſt will be in Danger of dying with Cold.

They may drill a greater Quantity than they have Strength of Cattle to manage; and then the ploughing of the two laſt Furrows of the Ridges may not be finiſhed till the Spring of the Year, which is the Seaſon wherein the ſecond Houghing ought to be perform'd, by throwing up to the Rows the fine Earth mellow'd by the Froſt, having

having lain open all the Winter for that Purpoſe; inſtead whereof theſe plough'd Furrows have not, perhaps, been mov'd in a Year and a half.

They may plant bad Seed, that will not grow, or that is foul, infected with the Smut, or of a wrong Sort of Wheat; for every Sort doth not equally ſuit every Soil, nor this Husbandry: The Sort that I have found to fit every ſoil that I have try'd it on, and makes the beſt hough'd Crop, is the White Cone; 'tis a White-bearded Wheat, whoſe Straw has a Pith like a Ruſh; alſo the Red Lammas Wheat, with white Ears, tho' it be a little dwarfiſh, makes a good Crop: The great Grey Cone too does well; but the Common red-ſtraw'd and White-ſtraw'd Lammas Wheat are more difficult to manage, eſpecially on ſuch Land as is uſually ſubject to the Blight of Inſects; for which Reaſon, I cannot adviſe a Beginner to venture on thoſe Sorts.

There is another Sort which I conjecture would exceed all other Sorts in this Husbandry; becauſe it is the largeſt of all, and requires the moſt Nouriſhment: It makes a Prodigious Crop in a Garden, but is much leſs when ſown in the Field in the common Manner. Its Ears in the Garden were the biggeſt I ever ſaw, having many ſmaller Ears all round the Bottoms of the great Ones, yet when ſown in the Field, the Ears in general were no bigger than thoſe of other Wheat; 'tis bearded but not grey. I have ſeen none of it theſe many Years, and therefore can only recommend it to be try'd by ſuch Drillers who know where to get it.

I would gladly ſave my Brother Drillers the Expence of weeding their Rows of Wheat before the Land has been cleans'd by Fallow or otherwiſe; but this cannot be done whilſt any ſpurious Seeds remain in it; unleſs Weeds had ſuch an Antiphathy to the Drill, as the Ancients fancy'd their Herba Medica had to Iron, ſo that they might refuſe to grow, becauſe the Drill paſs'd over them. But ſince 'tis ſo far otherwiſe, that Weeds will not only grow in the Rows, but alſo, if not taken out, receive as much Vigour from the Houghing, as the

Corn will; therefore, when Land is very ſubject to Weeds, that is to ſay, full of their Seeds and Roots, the cheapeſt Way of cleanſing it is, to plant thereon two ſucceſſive Crops of Turnips, or ſuch other Plants, amongſt which the Horſe-Hough and Hand-Hough may go near to extirpate the whole Race of Weeds, both annual and perennial. In the ſecond Year's Crop of Turnips, the Wheat may be drill'd in the Intervals before the Turnips are taken off. This I have done; but then they ought to be ſpent early; for if they ſhould ſtand all the Winter, they would injure the Wheat.

But, alas! where there is not Faith enough to drill Rows of Turnips ſo wide, as Three Foot aſunder, How ſhall there be Faith to plant the Rows Six Foot aſunder? But 'tis found, that a cempetent Number of Turnips, ſuppoſe Thirty-ſix, Forty-eight, or Sixty, drill'd on a Pearch of Ground in Rows Six Foot aſunder, may be brought to greater Perfection, than the ſame Number (be it which it will of them) can be brought on the ſame Perch drill'd in Rows Three Foot aſunder; tho' the wide Rows will be but about half the Expence of the narrow, and muſt be ill-managed, if they do not amount to the Quantity of Four Common-ſow'd Crops.

Many are prejudic'd againſt wide Intervals; but when that Matter ſhall be fully debated, they will be found to have been much in the Wrong. I call that a narrow Interval in Wheat, which is three Foot eight Inches, and that a wide one, which is four Foot eight Inches; this added Earth may be all of it well pulveriz'd, and when it is ſo, one Foot may have as much Vegetable Paſture *in it, as ten Foot of the ſame Earth unpulveriz'd; two Furrows houghs the wide, and there muſt be no leſs to hough the narrow: So that all the Difference of Expence is only the Rent of this added Foot. Now, an Acre being Sixty-ſix Foot wide, and Six Hundred and Sixty long, the Quantity of added Earth is Six Hundred and Sixty ſquare Feet; which, at the Rate of Eleven Shillings the Acre Rent, amounts to Two-pence,* and no more; and I can't think a treble Row to be well-manag'd, unleſs it produce two Buſhels of Wheat; which, at five Shillings the Buſhel, is Ten Shillings. But an ignorant Farmer, who is not us'd to this Way of Reckoning, when he ſees the wide Interval in the Winter or Spring, fancies there might be another Row in the Middle of it, as good as that Row; and thence computes the Difference of the wide and narrow Intervals at Ten Shillings, which is, in Truth, but Two-pence.

When the Driller deſires to know exactly the Quantity of his Wheat Crop, I adviſe him to cut a Row, or ſome certain Part thereof before the Reaper begin and ſee it Rubb'd or Threſh'd out immediately, and calculate his Crop by that; for tho' the neceſſary Waſte be leſs in this than in other Wheat, yet the Waſte may by Accident become very uncertain; for the Ears being very large, a great Company of Leaſers may (eſpecially when Corn is dear) leave behind them leſs than the Owner's uſual Share; or perhaps, the Threſher may throw one Half out of the Barn in the Straw, to increaſe his Wages, if he threſhes by the Quarter; or to ſave much of his Labour, if he threſhes by the Day.

I wiſh I could here give ample Directions in every Point of Management, with the Account of the whole Proceſs of my Practice of this Husbandry; but that cannot be expected to be done out of the proper Places. 'Tis certain, that what I now offer muſt needs be imperfect without the other Part; but I could take nothing elſe thence, without leaving the Remainder more imperfect.

Having accidentially heard that Drills have been made, and ſent a great Way to Strangers, who are going into this Practice, without any Experience or Knowledge of it; I could think of no better Way at preſent, to ſerve them and others who may do the ſame, than by giving them theſe Cautions; and aſſuring them, that, in my Opinion, if by any whatever Miſmanagement, they fail of Succeſs, the Fault will be imputed to the Husban-

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ry it ſelf; though if ſuch Miſmanagment (contrary to them) ſhould have ſucceeded, it muſt have been an Argument againſt the Truth of the Principles whereon the Husbandry *is founded: And that it may not be thus unjuſtly diſparaged, nor the Well-wiſhers to it injured by their own Raſhneſs, is what has induced me to publiſh theſe Papers, and my own Imperfections, I fear, too precipitately; on which Account I hope the Reader will pardon the Overſights I may have made, and alſo ſome which ſeem ſuch, until further explain'd.*

I Need not ſay Writing is none of my Buſineſs; but I hope the Farmer will not regard the Roughneſs of the Stile; becauſe he knows a Plough *will go never the better for being poliſh'd, though much the cheaper, for not being beſmear'd with Dung: Yet I muſt confeſs, that I have much leſs Averſion to Dung in the Field, than I have to the Expence of Buying and Carrying it thither. And I don't doubt, but many Farmers will hate that as much as I do, when they are convinc'd by their own Experience, they can go on very well without it: And if Hopes of Profit have ſo much Influence on their Inclinations, as to put them upon making Trials, I wiſh them Succeſs.*

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BRITISH MUSEUM 30 NOV 70

THE

New Horſe-Houghing Husbandry, &c.

Of Change of SPECIES.

I. *That Plants of the moſt different Nature, feed on the ſame Sort of Food.*

II. *That there is no Plant but what muſt rob any other Plant within its Reach.*

III. *That a Soil which is proper to one Sort of* Vegetable, *once, is, in reſpect of the Sort of Food it gives, proper to it, always.*

IF any one of theſe *Three Propoſitions* be true, as I hope to prove all of them are, then it will follow, that there is no need to change the Species of *Vegetables* from one Year to another, in reſpect to the different Food the ſame Soil is, tho' falſely, ſuppoſed to yield.*

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* For if all Plants rob one another, it muſt be becauſe they all feed on the ſame Sort of Food; and admitting they do, there can be no Neceſſity of changing the Species of them, from one Soil to another; but the ſame Quantity of the ſame Food, with the ſame Heat and Moiſture which maintains any Species one Year, muſt do it any other Year.

The common Opinion is contrary to all theſe (as it muſt be if contrary to any one of them) and ſince an Error in this fundamental Principal of *Vegetation* is of very ill Conſequence; and ſince Doctor *Woodward*, who has been ſerviceable in other Reſpects[*] to this Art, has unhappily fallen in with the Vulgar in this Point, his Arguments for this Error, require to be anſwer'd in the firſt Place.

The Doctor ſays, [†] "It is not poſſible to imagine how one uniform, homogenious Matter having its Principles, or Original Parts all of the ſame Subſtance, Conſtitution, Magnitude, Figure and Gravity, ſhould ever conſtitute Bodies ſo egregiouſly *unlike*, in all thoſe Reſpects, as Vegetables of different Kinds are; nay, even as the different Parts of the *ſame* Vegetable.

"That there ſhould be that vaſt difference in them, in their ſeveral Conſtitutions, Makes, Properties, and Effects, and yet all ariſe from the very ſame Sort of Matter, would be very ſtrange.

Anſwer. 'Tis very probable, that the Terreſtrial Particles which conſtitute *Vegetables*, tho' inconceivably Minute, may be of great Variety of Figure and other Differences, elſe they could not be capable of the ſeveral Ferments, *&c.* they muſt undergo in the Veſſels of Plants. Their ſmallneſs can be no Objection to their Variety, ſince even the Particles of Light are of various Kinds.

But as the Doctor aſſerts, "That each Part of the ſame *Vegetable* requires a peculiar ſpecifick Matter for its Formation and Nouriſhment; and that there are very many and different Ingredients go to the Compoſition of the ſame individual Plants:

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[*] By proving in his Experiments, that Earth is the *Pabulum* of Plants.

[†] In Philoſ. Tranſ. N. 253.

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BRITISH MUSEUM 30 NOV 70

FROM hence muſt be inferred, that the ſame Plant takes in very many and different Ingredients (and it is proved, that no Plant refuſes any Ingredient that is capable of entering its Roots.) * Tho the Terreſtrial Particles which nouriſh *Vegetables*, be not perfectly homogeneous, yet moſt of the various Taſtes and Flavours of Plants are made in, and by the Veſſels. †

DOCTOR *Woodward* ſays, " That Water will " paſs Pores and interſtices, that neither Air, nor " any other Fluid will; this enables it to enter the " fineſt Tubes and Veſſels of Plants, and to intro" duce the Terreſtrial Matter, conveying it to all " Parts of them; whilſt each, by Means of Organs " 'tis endow'd with for the Purpoſe, intercepts and " aſſumes into it ſelf, ſuch Particles as are ſuitable to " its own Nature; * letting the reſt paſs on *through* " *the Common Ducts*.

HERE then he ſays plainly, That each Plant receives the Terreſtrial Matter in Groſs, both Suitable and

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* Dr *Grew*, in his Anatomy of Plants by Microſcopical Inſpection, found, that the outer Superficies of Roots was of a ſpongy Subſtance; and 'tis well known that no ſuch Body can refuſe to imbibe whatever Liquour comes in contact with it, but will by its ſpringy Poroſity abſorb any Sort of Moiſture.

† We are convinced, that 'tis the Veſſels of Plants that make the different Flavour; becauſe there is none of theſe Flavours in the Earth of which they are made, until that has enter'd and been alter'd by the Vegetable Veſſels.

* If the Doctor's Plants were ſo nice in leaving Vegetable Matter behind quiet and undiſturb'd, 'tis a wonder they would take up the Mineral Matter, as he ſays they did that kill'd themſelves with Nitre.

Theſe Plants might with much leſs Difficulty have diſtinguiſh'd the Mineral Matter from the Vegetable Matter, than they could diſtinguiſh the different Particles of Vegetable Matter from one another, and muſt have been very unwiſe to chuſe out the nitre (their Poiſon) from the Water and Earth, and to leave the Vegetable Particles behind; none of which could be ſo improper to them as the Nitre.

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and unſuitable to its Nature, retains the Suitable Particles for its Augment, and the unſuitable lets paſs through it. And in another Place, he ſays, they are exhal'd into the Atmoſphere.

AND this will appear to be the true Caſe of Plants; and directly contradicts what he advances, in ſaying, " That each Sort of Grain takes forth that " peculiar Matter that is proper for its own Nou- " riſhment. Firſt, the Wheat draws off thoſe Par- " ticles that ſuit the Body of that Plant, *the reſt* " *lying all quiet and undiſturb'd the While.* And " when the Earth has yielded up all them, thoſe " that are proper for Barley, a different Grain, re- " main ſtill behind, till the ſucceſſive Crops of that " Corn fetch them forth too; and ſo the Oates and " Peas in their turn, till, in fine, all is carry'd off.

IN the former Paragraph, he ſays, Each Plant lets paſs through it the reſt of the Particles that are not ſuitable to its own Nature. In the latter Paragraph he ſays, that each leaves the unſuitable all behind for another Sort; and ſo on.

BOTH cannot be true.

IF the latter were True, Change of Sorts would be as neceſſary as it is commonly thought. But if

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It may, perhaps, be objected, that ſuch like pernicious Matter kills a Plant by only deſtroying its Roots, and by cloſing the Pores which prevents the Nouriſhment from entering to maintain its Life; and that ſuch Matter doth not it ſelf enter to act as Poiſon upon the Sap, or upon the Veſſels of the Body, or Leaves: But it plainly appears that it doth enter, and act as Poiſon; for when ſome of the Roots of Minth, growing in Water, are put into Salt Water, it kills the whole Plant, although the reſt of the Roots remaining in the Freſh Water were ſufficient to maintain it, if the other Roots had been cut off at the time they were removed into the Salt Water; and alſo all the Leaves, when dead, will be full of Salt.

Or if the Juice of Wild Garlick Seed be made Uſe of inſtead of the Salt Water, it will have the ſame Effect; and every one of the Minth Leaves will have a ſtrong Taſte of Garlick in it.

the former be true, as I hope to prove it is, then there can be no Uſe of Changing of Sorts in reſpect of different Nouriſhment.

IF in this Series of Crops each Sort were ſo Juſt as to take only ſuch Particles, as are peculiarly proper to it, letting all the reſt alone to the other Sorts to which they belonged, as the Doctor imagines; then it would be equal to them all, which of the Sorts were ſown firſt or laſt: But let the Wheat be ſown after the Barley, Peas, and Oats, inſtead of being ſown before them, and then it would evidently appear, by that ſtarv'd Crop of Wheat, either that ſome or all of thoſe other Grains, had violated this natural Probity, or elſe that Nature has given to *Vegetables* no ſuch Law of *Meum* and *Tuum*.*

IF theſe Things were as the Doctor affirms, why do Farmers loſe a Year's Rent, and be at the Charge of Fallowing and Manuring their Land, after ſo few Crops; ſince there are many more Sorts of Grain as different from theſe and one another, as thoſe are which they uſually ſow?

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* A Charlock could not rob a Turnip, and ſtarve it more than ſeveral Turnips can do, unleſs the Charlock did take from it the ſame Particles which would nouriſh a Turnip; and unleſs the Charlock did devour a greater Quantity of that Nouriſhment than ſeveral Turnips could take.

Flax, Oats, and Poppy, could not burn or waſte the Soil, and make it leſs able to produce ſucceeding Crops of different Species; unleſs they did exhauſt the ſame Particles, which would have nouriſh'd Plants of different Species: For let the Quantity of Particles, theſe Burners take, be never ſo great, the following Crops would not miſs them, or ſuffer any Damage by the Want or Loſs of them, were they not the ſame Particles, which would have nouriſh'd thoſe Crops, if the Burners had left them behind, quiet and undiſturbed. Neither could Weeds be of any Prejudice to Corn. if they did draw off thoſe Particles that ſuit the Bodies of Weeds, the reſt lying all quiet and undiſturb'd the while. But conſtant experience ſhews, that all Sorts of Weeds, more or leſs, diminiſh the Crop of Corn.

THEY ſtill find that the firſt Crops are beſt, and the longer they continue Sowing, the worſe the laſt Crops will prove, be they of never ſo different a Species; unleſs the Land were not in ſo good Tilth for the firſt Crop as for the ſubſequent; or unleſs the laſt ſown be of a more robuſt Species.

THIS Matter might be eaſily clear'd, could we perfectly know the Nature of thoſe ſuppoſed *unſuitable* * *Particles*, which the Doctor ſays paſs through the common Ducts; but, in Truth, there is no more to be known of ſuch of them, than that they are carried away by the Atmoſphere to a Diſtance, according to the Velocity of the Air; perhaps ſeveral Miles off, at leaſt, never like to return to the Spot of Ground from whence the Plants have raiſed them.

BUT ſuppoſe theſe caſt-off Particles were, when taken in, unfit for the Nouriſhment of any manner of Vegetables: Then the Doctor muſt fancy the Wheat to be of a very ſcrupulous Conſcience, to feed on theſe Particles, which were neither fit for its own Nouriſhment, nor of any other Plant; and at the ſame time to forbear to take the Food of Barley, Peas, and Oats, letting that lie ſtill, and undiſturbed the while, as he ſays it does, though he gives no manner of Reaſon for it.

'TIS needleſs to bring ſtronger Arguments, than the Doctor's Experiments afford, againſt his own vulgar Opinion, of Plants diſtinguiſhing the particular Sort of Terreſtrial Matter, that, he ſays, is proper to each Sort of *Vegetable*, in theſe Words, *viz.* " Each Sort takes forth that peculiar Matter " that is proper for its own Nouriſhment, the *reſt* " *lying all quiet and undiſturbed the while.*'

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* But we muſt not conclude, that theſe Particles, which paſs through a Plant (though a much greater Quantity than thoſe that abide in it for its Augment are all unſuitable, becauſe no one of them happens to hit upon a fit *Nidus*: For ſince the Life of Animals depends upon that of Plants, 'tis not unreaſonable to imagine, that Nature may have provided a conſiderable Overplus for maintaining the Life of individual Plants, when ſhe has provided ſuch an innumerable Overplus for continuing every Species of Animals.

HE ſays, That great Part of the Terreſtrial Matter, mixed with the Water, paſſes up into the Plant along with it; which it could not do, if only the peculiar Matter proper to each Plant, did paſs up into it: And after he has ſhewed how apt the *Vegetable Matter* is to attend Water in all its Motions, and to follow it into each of its Receſſes; being by no Filtrations or Percolations wholly ſeparable from it;

'TIS ſtrange he ſhould think that each Plant leaves the greateſt Part of it behind, ſeparated from the Water which the Plant imbibes.

THERE are, doubtleſs, more than a Million of Sorts of Plants, all of which, would have taken up the Water, and had each as much Right to its Share, or proper Matter in it, as the Doctor's Plants had; and then there would be but a very ſmall (or a Millionth) Part of it proper to each of his Plants, and theſe leaving all the reſt behind, both of the Water wherewith the Glaſſes at firſt were filled, when the Plants were put into them; and alſo of all the additional Water daily ſupply'd into them afterwards: I ſay, So much more Terreſtrial Matter brought into theſe Glaſſes, in Proportion to the added Water, and ſo very ſmall a Part as could be proper to each of his Plants being carried off; there muſt have remained in theſe Glaſſes a much greater Quantity of Terreſtrial Matter at the End of the Experiment, than remained in the Glaſſes *F* or *G*, which had no Plants in them, nor any Water added to, or diminiſhed from them; but the quite contrary appear'd. " And the Water in the Glaſſes *F* and *G* at the End " of the Experiment, exhibited a larger Quantity " of Terreſtrial Matter, than any of thoſe that had

" Plants in them did. The Sediment at the Bottom " of the Glaſſes was greater, and the *Nubiculæ* diſ- " fuſed thro' the Body of the Water thicker." Had the *Cataputia* inſum'd with the Two Thouſand Five Hundred and One Grains of Water, no more than its proper Share of the *Vegetable Matter*, it could not have attained thence an Increaſe of three Grains and a Quarter, nor even the thouſandth Part of one Grain. But he found, " This Terreſtrial Matter, contained " in all Water, to be of two Kinds: The one pro- " perly, a *Vegetable Matter*, but conſiſting of very " different Particles; ſome of which are proper for " the Nouriſhment of ſome Kinds of Plants, others " for different Sorts, *&c.*"

THIS, indeed, would have been a moſt wonderful Diſcovery, and might have given us a great Light, if he had told us in what Language and Character theſe proper Differences were ſtamp'd or written upon the *Vegetable Particles*; which Particles themſelves, he ſays, were ſcarce viſible. Certainly it muſt be a great Art (much beyond that of Doctor *Wallis*) to decypher the Language of Plants, from inviſible Characters.

DOCTOR *Woodward* ſeems to have had as good Eyes, and as ſtrong an Imagination, as the Old Woman, who ſaw the Needle upon the Barn, but could not ſee the Barn.

I WILL, by no means, call in Queſtion the Veracity of ſo learned and good a Man; and therefore am willing to believe he made this extraordinary Obſervation in his Sleep.

BUT that this Dream may deceive none, except ſuch who are very fond of old Errors, there is an *Experimentum Crucis* which may convince them, *viz.* At the proper Seaſon, tap a Birch-Tree in the Body or Boughs, and you may have thence a large Quantity of clear Liquor, very little altered from Water; and you may ſee that every other Species of Plants, that will grow in Water, will receive this; live, and grow in it, as well as in Common Water. You may make a like Experiment by tapping other Trees, or by Water diſtilled from Vegetables, and you will find no Species of Plants, into which this Water will not enter, and paſs through it, and nouriſh it too, unleſs it be ſuch a Species as requires more Heat than is in Water; or unleſs the peculiar Veſſels of that it has firſt paſſed through, have ſo altered the *Vegetable Particles* contained in that Water, as that it acts as Poiſon upon ſome other particular Species.

THE Doctor concludes, that Water is only the " *Agent* that conveys the *Vegetable Matter* to the Bo-" dies of Plants, that introduces and diſtributes it " to their ſeveral Parts for their Nouriſhment. That " *Matter* is ſluggiſh and inactive, and would lie eter-" nally confin'd to its Beds of Earth, without ever " advancing up into Plants, did not water, or ſome " like Inſtrument, fetch it forth, and *carry* it unto " them.

THAT Water is very capable of the Office of a Carrier, to Plants, I think the Doctor has made moſt evident; but as to the Office of ſuch an Agent as his Hypotheſis beſtows upon it, it ſeems impoſſible to be executed by Water. For it cannot be imagined that Water, being it ſelf but meet *Homegenial Matter*, void of all Degrees of Life, ſhould *diſtinguiſh* each Particle of *Vegetable Matter*, proper and peculiar to every different Species of Plants, which are innumerable; and when 'tis to act for the Wheat to find out all the Particles proper to that Sort of Grain, to rouſe only thoſe particular Sluggards from their Beds of Earth, letting all the reſt lie quiet and undiſturbed the while. This *Agent* frees the Wheat Particles from their Confinement, and conveys, introduces, and diſtributes them, and only them, into the ſeveral Parts of the Wheat. Certainly no Mortal, except Doctor *Woodward*, can pretend to diſtinguiſh the Particles of *Vegetable Matter* by any Characters, Hieroglyphicks, or other Manner whatever, ſo as to determine to what Species, or Claſs of Plants, they are ſeverally proper and peculiar; neither is it probable, that any Bonatiſt is acquainted with half the diſtinct Species of *Vegetables*. Yet all the *Vegetable Particles* and *Species*, muſt be perfectly and diſtinctly known by Water, before it be capable of performing ſuch a nice Task of an *Agent*; elſe, when Wheat, Barley, and Oates, are all growing together, in the ſame Foot of Ground, with their Roots, ſo intangled together, that no Man can poſſibly diſtinguiſh the one from the other, by viewing the Roots; How ſhould this inſenſible *Agent* be punctual in delivering to each its own proper Particles? For, though the *Agent* had moſt exactly executed a Commiſſion of diſturbing the Inactivity of theſe three Sorts of Particles only; yet, when it had fetched them forth, if it ſhould err in the Delivery of them, and carry the Wheat-Particles to the Barley, and thoſe of Barley to the Oats, it would be a Miſtake of worſe Conſequence, according to the Doctor's Opinion, than that of the *London* Undertaker's, who being to inter an old Man in *Northumberland*, and a young Lady in *Cornwall*, carried the Man to *Cornwall*, and the Lady to *Northumberland*: Her Mother, for Mitigation of Grief, would not be ſatiſfied without a laſt Sight of her Daughter's Corpſe; but when the Coffin was opened, the error was diſcovered by the indubitable Criterion of an old ſhrivel'd Face, with a huge grey Beard. 'Tis no real Injury to a Perſon deceas'd, if the Place of his Burial be miſtaken; but if Water ſhould miſtake thus in the Taking up, Carrying, and Delivery of *Vegetable Particles*, all Plants would be (upon the Doctor's Hypotheſis) ſtarv'd or poiſon'd, and Animals could not long ſurvive all Plants. But ſince all the different Species of Plants do continue live, their Life proves, that the *Vegetable Particles* Earth are not proper, but *common* to them all for their Nouriſhment, if theſe Particles are taken up, carried and introduced into the *Vegetable* Veſſels by Water; which is capable of diſtinguiſhing neither different *Vegetable Particles*, nor different *Vegetables*.

SINCE 'tis unreaſonable to believe, that Water can have ſuch extraordinary Skill in *Botany* or in *Micrography*, as to be qualified for a ſufficient Agent in ſuch an abſtruſe Matter, I conceive Water to be only an Inſtrument or Vehicle, which takes up indiſferently any Particles it meets with (and is able to carry) and advances them up into the firſt Plant whoſe Roots it comes in Contact with; and that every Plant it meets with, does accept thereof, without diſtinguſhing any different Sorts or Properties in them, until they be ſo far introduc'd and advanc'd up into the *Vegetable* Veſſels, that it would be in vain to diſtinguiſh them; for whether the Terreſtrial Matter, Plants imbibe with the Water, will kill or nouriſh them, appears by its Effects; but which cannot be foreknown or prevented without the Help of Faculties, which Plants are not endow'd with.

MR. *Bradley* ſeems to have carried this Error farther than any Author ever did before; but he ſupports it by Affirmations only, or by ſuch Arguments (I cannot ſay Reaſons, for no Reaſon can be againſt any Truth) as go near to confute the very Opinion he pretends to advance by them.

HE aſcribes to *Vegetables* the Senſe of Taſte, by which, he thinks they take ſuch Nouriſhment, as is moſt agreeable to their reſpective Natures, refuſing the reſt; and will rather ſtarve than eat what is diſagreeable to their Palate.

IN the Preface to his *Vol.* I. *Page* 10. of his *Husbandry and Gardening*, he ſays, " They feed as diſ-" ferently as Horſes do from Dogs, or Dogs from " Fiſh;

BUT what does he mean by this Inſtance *Vol.* I. *p.* 39? *viz.* “ That Thyme and other Aromaticks, “ being planted near an Apricot-Tree, would de- “ ſtroy that Tree; helps to confirm, that every “ Plant does not draw exactly the ſame Share of “ into Nouriſhment.

I BELIEVE there is no need for him to give more Inſtances to diſprove his Aſſertion than this one. His Concluſion, taken by it ſelf, is ſo far right, *viz.* “ That if the Nouriſhment the Earth, afforded to “ the Thyme and Apricot-Tree, had been *divided* “ into two Shares, both could not have had them.

BUT this his Inſtance proves, that thoſe Aromaticks robb'd the Apricot-Tree of ſuch of its Share as to ſtarve it; and that they, tho' of ſo very different a Nature, did draw from the Earth the ſame Nouriſhment which the Apricot-Tree ſhould have taken for its Support, had not the Aromaticks been too hard for it, in drawing it off for their own Maintenance.

UNLESS he believes that all the Juices of the Aromaticks were as Poiſon to the Apricot, and that, according to my Experiment of the Minth, mark'd (*b*), ſome of their Roots might diſcharge ſome kind of Moiſture in dry Weather, given them by others, that had it for their Uſe; and that the Apricot Roots, mingling with them, might imbibe enough of that Liquor, altered ſufficiently by their Veſſels, to poiſon and kill the Tree.

BUT then, Where was the Trees's diſtinguiſhing Palate? Why did it not refuſe this Juice, which was ſo diſagreeable as to kill it? And as to his Notion of *Vegetables* having Palates, let us ſee how it agrees with what he affirms.

“ THAT 'tis the Veſſels of Plants that make, by “ their Filtrations, Percolations, &c. all the diffe- “ rent Taſtes and Flavours of the Matter, which is “ the Aliment of Plants; and that before it be by

“ them ſo filtred, &c. it is only a Fund of *inſipid*
“ *Subſtance*, capable of being altered by ſuch Veſſels,
“ into any Form, Colour, or Flavour.”

AND *Vol.* I. *p.* 38. “ The different Strainers, or
“ Veſſels of the ſeveral Plants, growing upon that
“ Spot of Earth, thus impregnated with Salts, alter
“ thoſe Salts or Juices, according to the ſeveral Figures
“ or Dimenſions of their Strainers; ſo that
“ one Plant varies, in Taſte and Smell, from others,
“ tho' all draw their Nouriſhment from the ſame
“ Stock lodged in the Earth.” See Mr. *Bradley*'s *Palates of Plants*, and the *inſipid Subſtance* he allots them, to diſtinguiſh the Taſte of, how they agree.

THEY muſt, it ſeems, within their own Bodies, give the Flavour to this inſipid Subſtance, before their Palates can be of any Uſe; and even then, 'tis impoſſible to be of any Uſe, but in the Manner of the Dog returning to his *Vomit*.

THEY would have as much Occaſion for the Senſe of Smelling, as of Taſte; but, after all, of what Uſe could either of the two be to Plants, without local Motion of their Roots, which they are ſo deſtitute of that no Mouth of a Root can ever remove it ſelf from the very Point where it was firſt formed, becauſe a Root has all it's Longitudinal Increaſe at the very End; for ſhould the Spaces betwixt the Branchings increaſe in Length, thoſe Branches would be broken off and left behind, or elſe drawn out of their Cavities, which muſt deſtroy the Plant.

ALL the Branches, except the foremoſt, would be found with their Extremities pointing towards the Stem; the contrary of which Poſture they are ſeen to have: And if they moved backwards, that would have much the ſame Effect on all the Collateral Branchings to deſtroy them. Smell and Taſte then could be of no manner of Uſe to *Vegetables*; if they had them; they would have no Remedy or Poſſibility to mend themſelves from the ſame Mouths, removing to ſearch out other Food, in caſe they had Power to diſlike or refuſe what was offered them.

THEREFORE, the crude Earth being their Food ſimple and free from any Alterations by Veſſels, remaining inſipid, cannot give, neither can Plants receive, require, or make Uſe, of any Variety from it, as Animals do from their Diet. It would be loſt upon them, and Nature would have acted in vain, to give Smell and Taſte to *Vegetables*, and nothing but inſipid Earth for an Object of them; or to give them a charming Variety of Reliſh and Savour in their Food, without giving them Senſes neceſſary to perceive or enjoy them; which would be like Light and Colours to the Blind, Sound and Muſick to the Deaf; or like giving Eyes and Ears to Animals, without Light or Sound to affect them.

THE Mouths of Plants, ſituate in the Covex Superficies of Roots, are analogous to the Lacteals, or Mouths, in the Concave Superficies of the Inteſtines of Animals..

THESE ſpongy Superficies of Animal Guts, and Vegetable Roots, have no more Taſte or Power of refuſing whatever comes in Contact with them, the one than the other.

THE free open Air would be equally injurious to both; and if expoſed to it, it would dry and cloſe up the fine Orifices in Guts and Roots; therefore Nature has guarded both from it.

NATURE has alſo provided for the Preſervation of both Vegetables and Animals (I do not ſay equally) in reſpect of their Food, which might poiſon them, or might not be fit to nouriſh them.

THE Security of Plants (the beſt that can be) is their Food it ſelf, Earth; which having been altered by no Veſſels, is always ſafe and nouriſhing to them: For a Plant is never known to be poiſoned by its own natural Soil, nor ſtarved, if it were enough of it with the requiſite Quantities of Heat and Moiſture, ROOTS being therefore the Guts of Plants, have no need to be guarded by Senſes; and all the Parts and Paſſages, which ſerve to diſtinguiſh and prepare the Food of Annimals, before it reach the Guts, are omitted in Plants, and not at all neceſſary to them.

BUT as the Food of moſt Animals is Earth, very variouſly changed and modified by Vegetable or Animal Veſſels, or by both, and ſome of it is made wholſome, ſome poiſonous; ſo that if this doubtful Food ſhould be committed to the Inteſtines, without Examination, as the pure unaltered Earth is to Roots, there would, in all Probability, be very few Animals living in the World, except there be any that feed on Earth at firſt Hand only, as Plants do.

THEREFORE, leſt this Food, ſo much more refined than that of Plants, ſhould, by that very Means, become a fatal Curſe, inſtead of a Bleſſing, to Animals, Nature has endowed them with Smell and Taſte, as Centinels, without whoſe Scrutiny theſe various uncertain Ingredients are not admitted to come where they can enter the Lacteals, and to diſtinguiſh, at a ſufficient Diſtance, what is wholeſome and friendly, from what is hurtful; for when 'tis once paſt out of the Stomach into the Guts, 'tis too late to have Benefit from Emeticks; its Venom muſt then be imbibed by the Lacteal Mouths, and mix with the Blood, as that muſt mix with the Sap, which comes in Contact with the Lacteals in the Superficies of Roots, Nature having left this unguarded.

YET, Plants ſeem to be better ſecured by the Salubrity and Simplicity of their Food, than Animals are by their Senſes: To compenſate that Inequality of Danger, Animals have Pleaſure from their Senſes, except ſome miſerable Animals (and ſuch there are) that have more Pain than Pleaſure from them. But, I ſuppoſe, more Animals than Plants are poiſoned; and that a poiſonous Animal is leſs fatal to a Plant, than a poiſonous Plant is to an Animal. An Inſtance of this I have been told, by very credible Perſons, that a Man walking in a Garden, gathered a Sprig of Sage, and eat it, which ſoon brought upon him the Symptoms of Poiſon, and Death. They dug up the Root of Sage, and found a Toad under it.

SOME of the Effluvia, or Excrementitious Juices of this loathſome Animal, had paſſed the Veſſels of that wholſome Plant, without any apparent Injury to it, though all its Strainers were not able to correct the Venom.

HERE I remark, that the Minth (E) ſuffered more peſtiferous Effects from the Garlick, of its own Genus, than the Sage did from the Toad, though of a different Genus.

IT killed the Man, but was not ſtrong enough to kill the Sage. This ſhews, that Plants have not occaſion of Palates, as Animals have.

I SAY no more of Mr *Bradley*'s *Vegetable Palates*; I proceed to ſome other Arguments againſt the Neceſſity of Changing Sorts of *Vegetables* on Account of their taking different Nouriſhment.

IT being ſufficiently proved, That every Sort of *Vegetables* growing in the ſame Soil, takes, and is nouriſhed by the ſame Sort of Food; it follows from hence, That the beneficial Change of Sorts of Seeds or Plants, we ſee in the common Husbandry, is not from the Quality of the Sorts of Food, but from other Cauſes; ſuch as,

I. *Quantity of the Food*,
II. *Conſtitution of the Plants*.
III. *Quantity of the Tillage*.

IN Doctor *Woodward*'s Caſe, upon his Hypotheſis, the three Proportions of Seeds, *viz.* Barley, Oats, and Peas, might be ſown all together in the ſame Acre of Ground, the ſame Year, and make three as good Crops as if ſown ſingly in three ſucceſſive Years, and his two Crops of Wheat in one Year likewiſe.

wiſe. But every Farmer can tell, that theſe three Proportions of Seed would not yield half the Crop together, as one would do ſingle; and would ſcarce produce more than to ſhew what Grains were ſown, and which of the Sorts were the ſtrongeſt, and the moſt able, Robber.

THOUGH this Failure would, in Truth, be from no other Cauſe than want of the ſufficient Quantity of Food, which thoſe three Crops required; yet, perhaps, the Doctor might think that all three Crops might ſucceed together very well, taking each its proper Nouriſhment, were it not for want of *Room*, *Air*, and *Sun*.

I HAVE been credibly inform'd, that on one Perch of Ground there has grown a Buſhel of Corn, which is twenty Quarters to an Acre. Mr. *Houghton* relates twenty-ſix, and even thirty Quarters of Wheat on one Acre. There has certainly grown twelve Quarters of Barley to an Acre, throughout a whole Field: Therefore, unleſs a Crop exceed the leaſt of theſe, or, indeed, the greateſt of them (if the Relation be true) a Crop cannot fail for want of Room; for one Acre (be it of what Nature it will, as to the Soil of it) muſt have as much Room for a Crop to grow on, as any other Acre.

THEN there was Room for all Doctor *Woodward*'s three Crops together, to produce as much as three common Crops do. Yet all theſe together will ſcarce yield one Quarter of Corn, though there is Room, at leaſt, for twelve.

THE ſame *Air* and *Sun* that had Room to do their Office to Mr. *Houghton*'s Acre, why ſhould they not have Room to do the ſame to Doctor *Woodward*'s Acre, when the three Crops growing on it at once, though pretty good ones, might require leſs Room than Mr. *Houghton*'s Crop did?

I PERCEIVE that thoſe Authors who explain *Vegetation*, by ſaying the Earth imbibes certain Qua-

lities

lities from the Air, and by Specifick Qualities, and the like, do alſo lay a great Streſs upon the *Perpendicular* Growth of *Vegetables*; ſeeming to fancy there is little elſe neceſſary to a good Crop, but Room.

MR. *Bradley*, in his Arguments concerning the Value of a Hill, does implicitly ſay as much.

BUT if they would but conſider the Diameters of the Stems, with the Meaſure of the Surface of an Acre, they would be convinced, that many, even of Mr *Houghton*'s Crops, might ſtand in a perpendicular Poſture upon an Acre, and Room be left.

FOR Mr. *Houghton* calcŭlates, that in ſuch a prodigious Crop, there is two Inches and a half of Room to each Ear.

ONE true Cauſe of a Crop's Failing, is want of Quantity of Food to maintain the Quantity of *Vegetables* which the Food ſhould nouriſh.

WHEN the Quantity of Food which is ſufficient for another Species (that requires leſs) but not for that which laſt grew, to grow again the next Year, then that other is beneficial to be planted after it.

THE ſecond true Cauſe is from the Conſtitution of Plants; ſome require more Food than others, and ſome are of a ſtronger Make, and better able to penetrate the Earth, and forage for themſelves.

THEREFORE Oats may ſucceed a Crop of Wheat on ſtrong Land, with once Ploughing, when Barley will not; becauſe Barley is not ſo well able to penetrate as Oats, or Beans, or Peas are.

SO a Pear-Tree may ſucceed a Plumb-Tree, when another Plumb-Tree cannot; becauſe a Pear is a much ſtronger Tree, and grows to a much greater Bulk, ſo inclined to be a Giant, that 'tis hard to make it a Dwarf; and will penetrate and force its Way thro' the unmoved Earth, where the other cannot, being of a weaker and leſs robuſt Conſtitution, not ſo well able to ſhift for it ſelf.

THE Pear could penetrate Pores that the other could not. Mr. *Evelyn* ſays, in his Diſcourſe of Foreſt-Trees, 'That a Pear will ſtrike Root thro' the 'roughest and moſt impenetrable Rocks and Clifts 'of Stone it ſelf.' He ſays likewiſe, in his *Pomona*, 'That Pears will thrive where neither Apple 'or other Fruit could in Appearance be expected.'

I CAN ſcarce think, that a large Plant takes in larger Particles than a ſmall one for its Nouriſhment; if it did, I can't believe, that the Thyme could have ſtarv'd the Apricot-Tree; it muſt have left the larger Particles of Food for that Tree, which probably would have ſufficed to keep it alive; I rather think, that great and ſmall Plants are ſuſtain'd by the ſame minute Particles: For as the fine Particles of Oats will nouriſh an *Ox*, ſo they will nouriſh a *Tom-Tit*, or a *Mite*.

SOME Plants are of a hotter Conſtitution, and have a quicker Digeſtion, like Cormorants or Pigeons, devouring more greedily, and a greater Quantity of Food than thoſe of a colder Temperature, of equal Bulk, whoſe Sap having a more languid Motion, in Proportion to the leſs Degree of Heat in it, ſends off fewer Recrements, and therefore a leſs Supply of Food is required in their Room. This may make ſome Difference in the one's ſucceeding the other; becauſe the hot-conſtitution'd leaves not enough for its own Species to ſucceed again, but leaves enough for a Species of a colder Conſtitution to ſucceed it.

BUT the third and chiefeſt Cauſe of the Benefit of changing Sorts, is Quantity of *Tillage*, in Proportion to which the Food will be produced.

THE true Cauſe why Wheat is not (eſpecially on any ſtrong Soil) to be ſown immediately after Wheat, is, That the firſt Wheat ſtanding almoſt a Year on the Ground, by which it muſt grow harder; and Wheat Seed-Time being ſoon after Harveſt in *England*,

land, there is not Space of Time to Till the Land ſo much as a Second Crop of Wheat requires.

Tho' ſometimes in poorer Land that is lighter, Wheat has ſucceeded Wheat with tolerable Succeſs, when I have ſeen on very rich ſtrong Land, the firſt Crop loſt by being much too big, and one following it immediately, quite loſt by the Poorneſs of it, and not worth Cutting.

This was enough to ſatisfy, that the *Tillage* which was ſo much eaſier perform'd in leſs time, ſufficed for the light Land, but not for the ſtrong; and if the ſtrong Land would have been brought into as good Tilth as the light, (like as in the *New Husbandry* it may) it would have produced a much better Second Crop than the light Land did.

From all that has been ſaid, theſe may be laid down as Maxims, *viz.* That the ſame Quantity of *Tillage* will produce the ſame Quantity of Food in the ſame Land: *And*, That the ſame Quantity of Food will maintain the ſame Quantity of *Vegetables*.

'Tis ſeen, that the ſame Sort of Weeds which once come naturally in a Soil, if ſuffer'd to grow, will always proſper in Proportion to the *Tillage* and Manure beſtow'd upon it, without any Change. (And ſo are all manner of Plants that have been yet try'd by the *New Husbandry*, ſeen to do.)

A Vineyard, if not Till'd, will ſoon decay, even in rich Ground, as may be ſeen in thoſe in *France*, lying intermingled as our Lands do in Common Fields. Thoſe Lands of Vines, which by Reaſon of ſome Law-Suit depending about the Property of them, or otherwiſe, lie a Year or two Untilled, produce no Grapes, ſend out no Shoots hardly; the Leaves look Yellow, and ſeem dead, in Compariſon of thoſe on each Side of them, which being Tilled, are full of Fruit, ſend out a Hundred times more Wood, and their Leaves are large and flouriſhing;

and continue to do the ſame annually for Ages, if the Plough or Hough do not neglect them.

NO Change of Sorts is needful in them, if the ſame annual Quantity of *Tillage* (which appears to provide the ſame annual Quantity of Food) be continued to the Vines.

BUT what in the *Vineyards* proves this Theſis moſt fully, is, That where they conſtantly Till the Low Vines with the Plough, which is almoſt the ſame with the Hough-Plough, the Stems are planted about four Foot aſunder, Chequerwiſe; ſo that they plough them four Ways. When any of theſe Plants happen to die, new ones are immediately planted in their Room, and exactly in the Points or Angles, where the other have rotted; elſe, if planted out of thoſe Angles, they would ſtand in the Way of the Plough. Theſe young Vines, I ſay, ſo planted in the very Graves, as it were, of their Predeceſſors, Grow, Thrive, and Proſper well, the Soil being thus conſtantly Tilled: And if a Plumb-Tree, or any other Plant had ſuch *Tillage*, it might as well ſucceed one of its own Species, as thoſe Vines do.

'TIS obſerved, that White-Thorns will not proſper ſet in the Gaps of a White-Thorn Hedge: But I have ſeen the Banks of ſuch Gaps dug, and thrown down one Summer, and made up again, and White-Thorns there re-planted the following Winter, with good Succeſs.

BUT note, That the annual Ploughing the Vines is more beneficial than the one Summer *Tillage* of the Banks, the Vines having it repeated to them yearly.

I HAVE by Experience and Obſervations, found it to be a Rule, That *Long Tap-rooted Plants*, as *Clover* and *St. Foin*, will not ſucceed after thoſe of their own or any other Species of *Long Tap-Roots*, ſo well as after Horizontal-rooted Plants; but, on the contrary, Horizontal, will ſucceed thoſe *Tap-*

Roots as well or better than they will ſucceed Horizontal.

I CONFESS, this Obſervation did, for a great while *cheat* me into the common Belief, That different Species of Plants feed on different Food; till I was delivered from that Error, by taking Notice, that thoſe *Tap-Roots* would thrive exceedingly well after Turnips, which have alſo pretty long *Tap-Roots*, though Turnips never thrive well immediately after *Clover* or *St. Foin*; I found the true cauſe of this Exception to that Rule, to be chiefly the different *Tillage*.*

LAND muſt be well Tilled for Turnips, which alſo are commonly Houghed; they ſtand ſcarce ever above three Quarters of a Year, and are then fed on the Ground, and then the ſucceeding Crop of Corn has, by that means, the Benefit of twice as much *Tillage* from the Hough as otherwiſe would be given to it; and the Broad Clover or *St. Foin*, ſown with the Corn (if the Corn be not ſo big as to kill it) will enjoy, in its Turn, a Proportion of the extraordinary *Tillage*, and Dung of Cattle, which feed the Turnips, and thrive accordingly.

BUT Broad *Clover* and *St. Foin*, being perennial Plants, ſtand on the Ground ſo long, that it lies ſeveral Years untilled; ſo that Turnips, ſown immediately after theſe, do fail, for want of their due Tillage, for which there is not ſufficient Time, by ploughing often enough, becauſe, by the common Ploughs, it requires two or three Years to make it fine enough for Turnips, or for a Repetition of Clover or *St. Foin*, in ſtrong or ſwerdy Land.

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* Very mellow rich Land is ſo full of Vegetable Food, that 'tis an Exception to moſt Rules; and therefore I ſpeak not of That.

ANOTHER Reaſon why any Crop ſucceeds well after Turnips (and beſides their being ſpent on the Ground where they grow) is their cold Conſtitution, by which they are maintained with leſs Food than another Plant of the ſame Bulk.

THE *Parenchyma*, or fleſhly Part of a Turnip, conſiſting of a watry Subſtance, which *cools* the *Veſſels*, whereby the Sap's Motions is very languid, in Proportion to the very low Degree of Heat it has, and ſends off its Recrements in the ſame Proportion likewiſe; and therefore requires the leſs of the terrene Nouriſhment to ſupply thoſe Recrements.

THIS is ſeen, when a Buſhel of Turnips mix'd with a Quantity of Wheaten Flour, is made into Bread, and well baked: This Buſhel of Turnips gives but few Ounces Increaſe in Weight, more than the ſame Quantity of Wheaten Flour made into Bread, and baked without any Turnips. This ſhews there is in a Turnip very litte Earth (which is the moſt permanent Subſtance of a Plant) the Oven diſcharges, in Vapour, near all but the largeſt Veſſels: Its Earthy Subſtance being ſo ſmall, is a Proof 'tis maintained by a ſmall Quantity of Earth; and upon that Account, alſo of leſs Damage to the next Crop than another Plant would be, which required more of the ſolid Nouriſhment to conſtitute its firmer Body, as a Charlock does; for when a Charlock comes up, contiguous to, and, at the ſame time, with, a Turnip, it does ſo rob the Turnip, that it attains not to be of the Weight of five Ounces; when a ſingle Turnip, having no more Scope of Ground, and, in all reſpects (but the Vicinity of the Charlock) equal, weighs five Pounds, yet that Charlock does not weigh one Pound.

AND where three Turnips coming up, and growing thus contiguous, will weigh four Pounds; a Charlock joined with two or three Turnips, all together will be leſs than one Pound, upon no leſs Space of Ground.

THIS Obſervation cannot be made, except where Turnips are drill'd in Rows; and there 'tis eaſy to demonſtrate, that a Charlock, during the time of its ſhort Life, draws much more Earth than a Turnip of equal Bulk, from an equal Quantity of Ground.*

THE true Cauſe why *Clover* and *St. Foin* do not ſucceed ſo well after their own reſpective Species, or that of each other, as Corn, &c. can, is, that they take great, or greateſt, Part of their Nouriſhment from below the Plough's Reach, ſo as that Under-Earth cannot be tilled deep enough, but the upper Part may be tilled deep enough for the Horizontal Roots of Corn, &c. towards which, the Rotting of the *Clover* and *St. Foin* Roots, when cut off by the Plough, do not a little contribute. And there's no doubt but that, if the Under-Earth could be as well tilled for the Tap-Roots, as the Upper-Earth is for the Horizontal, The Tap-Roots would ſucceed one another as well as the Horizontal would ſucceed them, or thoſe of their own Species, or, as the Tap-Roots do the Horizontal.

THE Under-Earth, in ſome time, is repleniſhed by what the Rains leave, when they ſink through it; and then Tap-rooted Plants may be there nouriſhed again, though the Upper-Earth be drained by the Corn; ſo that no Change is ſo beneficial, as that betwixt Tap-rooted Plants, and thoſe which have only Horizontal ones. The former are provided for by Rains, though not ſo ſpeedily as the latter are by Tillage and Houghing.

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* 'Tis certain that Turnips, when they ſtand for Seed, ſuck and impoveriſh the Ground exceedingly; for though they are of a cold Conſtitution, and conſequently conſume leſs Food than Plants of a hotter Conſtitution, and of the ſame Bulk: Yet, theſe Seed-Turnips being of ſo vaſt a Bulk, as ſometimes eighty Quarters of their Roots on an Acre, and their Stalks have been meaſured ſeven Foot high; and their Roots having continued at near their full Bigneſs for about ten Months together, and then carried off, they drain the Land more than a Crop of other Vegetables of leſs Bulk and a hotter Conſtitution, and which live a leſs Time; or than Wheat, which, though it lives as long, is very ſmall, except in the four laſt Months.

PASTURES require no Change of Herbs; becauſe they have annually the ſame Supply of Food from the Dunging of Cattle that feed on them, and from the Benefit of the Atmoſphere.

MEADOWS hold out without Change of Species of Graſs, though a Crop be carried off every Year; the Richneſs of that Soil, with the Help of the Atmoſphere, Dung of Cattle in feeding the After-Crop, or elſe Flooding, from the overflowing of ſome River, ſome, or all of which, ſupply the Place of the Plough to a Meadow.

WOODS alſo hold out beyond Memory or Tradition, without changing Sorts of Trees; and this, by the Leaves, and, perhaps, old Wood rotting on the Soil annually, which operates as a Manure, becauſe, as has been ſaid, Earth which has once paſſed any Veſſels, is ſo changed, that for a long time after, it does not regain its *Homogeneiety* * ſo much as to mix with pure Earth, without fermenting; which, with the Deſcent of the Atmoſphere, and the Trees ſhadowing the Soil, prevents the Re-aſcent of what that brings down; all this imitates *Tillage*, and by continually dividing the Soil, renews the Food equal to the Conſumption of it made by the Wood.

AND the laſt Argument I ſhall attempt to bring for Confirmation of all I have advanc'd, is, that which proves both the Truth and Uſe of the reſt, *viz.* That when any Sort of *Vegetable*, by the due Degrees of Heat and Moiſture it requires, is agreeable to a Soil, it may, by the *New Horſe-Houghing Husbandry*, be continued without ever changing the Species

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* Not that the Particles of Earth are ſtrictly *Himogeneous*, but that they are much leſs *Heterogeneous* before they are altered by Veſſels, than afterwards.

Of Change of *INDIVIDUALS.*

SEEDS, in their natural Climate, do not degenerate, unleſs Culture has improved them; and then, upon Omiſſion of that Culture, they return to their firſt natural State.

As the Benefit of changing of *Species* of Seeds, is from Difference of *Tillage*, ſo the Benefit of changing *Individuals* of the ſame Species, appears to be from thoſe cauſes, which are generally, themſelves, the Effects of different Climates, ſuch as Heat and Moiſture, which may alſo vary very much in the ſame Latitude and Neighbourhood; as the ſame Mountain, in the Country of the *Mogul* (related by Mr. *Evelyn*, from *Monſieur Bernier* on the South Side produces *Indian* Plants, and on the North Side *European* Plants, from different Expoſures; and ſome Land retaining Water longer, is colder; ſome ſuffering it to paſs down quicker, and by the Nature and Figure of its Parts, cauſes ſuch a Refraction, and Reflection of the Sun's Rays, which give a great Warmth as in Sand and gravelly Grounds, that are well ſituate, and have an *Under-Stratum* of ſome Sort of hollow Matter, next under the Staple, or *Upper-Stratum*, wherein the Plough is exerciſed.

This beneficial *Change of Individuals* ſeems rather to be from the fore-mentioned Cauſes, than from Change of Food; and theſe Cauſes ſhew their Efficacy, chiefly in the Generation, or Fœtation of thoſe Seeds; as Flax Seed brought from *Holland*, and ſown here, will bring as Fine Flax as there; but the very next Generation of it *coarſer*, and ſo degenerating gradually, after two or three Deſcents, becomes no better than the common ordinary Sort; yet its Food is the ſame, when the Flax is Fine, as when 'tis coarſe.

And ſo it is, when *Individuals* of Wheat are changed; ſo Silk Worms, hatch'd and bred in *France* of Eggs, or Seed, brought from *Italy*, will make as fine Silk as the *Italian*; but the Eggs of theſe lain in *France*, and their Iſſue, will make no better Silk than the *French*; though their Food be from Leaves of the ſame Mulbery Trees, when they make fine Silk and coarſe; therefore 'its from the Climate where the Eggs are impregnated, not where they have their Incubation, or Food when hatch'd, and fed to their Lives-End, that this Difference happens.

COMMON Barley ſown once in the burning Sand at *Patney* in *Wiltſhire*, will, for many Years after, if ſown on indifferent warm Ground, be *ripe* two or three Weeks ſooner than any other, which has never been impregnate at *Patney*: But if ſown a Degree farther North, on cold, clayey Land, will, in two or three Years, *loſe* this Quality, and become as late ripe as any other.

INDEED, *Patney* is far from Improving the Species of Barley, except we think it improved by becoming more weak and tender, and *ſhorter-lived*; which laſt mentioned Quality fits it for ſuch Countries, where the Summers are too ſhort for other Barley to ripen.

THE Grains, or Seeds of *Vegetables*, are their Eggs, and the *Individual Plants*, immediately proceeding from them, have not only the Virtues they received in Embyro (or rather in *Plantulis*) but the *Diſeaſes* alſo; for when Smutty Wheat is ſown, unleſs the Year prove very favourable, the Crop will be Smutty; which is an evident Token of *Mala Stamina*.

THE ſmutty Grains will not grow, for they turn to a black Powder; but when ſome of theſe are in a Crop, then, to be ſure, many of the reſt are infected; and the Diſeaſe will ſhew it ſelf in the next Generation, or Deſcent of it; if the Year wherein 'tis planted, prove a wet one.

WEEDS, and their Seed, in the Fields where they grow naturally, for Time immemorial, come to as great Perfection as ever, without Change of Soil.

These Weeds, with Acorns, and other Maſts, Crabs, Sloes, Hips, and Haws, are thought to have been, originally, the natural Product of our Climate; therefore, moſt other Plants, being Exoticks, many of them, as to their *Individuals*, require Culture, and Change of Soil, without which they are liable, more or leſs, to degenerate.

But to ſay, that the Soil can cauſe Wheat to degenerate into Rye, or convert Rye into Wheat, is what reflects upon the Credit of *Laurembergius*: 'Tis as eaſy to believe, that a Horſe, by feeding in a certain Paſture, will degenerate into a Bull, and in other Paſture revert to a Horſe again; theſe are ſcarce of more different Species than Wheat and Rye are: If the different Soil of *Wittemberg*, and *Thuringia*, change one Species, they may the other.

Of *RIDGES.*

THE Method of ploughing Land up into *Ridges*, is a particular Sort of *Tillage*; the chief Uſe of which is the Alteration it makes in the Degrees of Heat and Moiſture, being two of the grand Requiſites of *Vegetation*; for very different Degrees of theſe are neceſſary to different Species of *Vegetables*.

Those *Vegetables* commonly ſown in our Fields, require a middle Degree of both, not able to live on the Sides of perpendicular Walls in hot Countries, nor under Water in cold ones, neither are they Amphibious, but muſt have a Surface of Earth not cover'd nor much ſoak'd with Water, which deprives them of their neceſſary Degree of Heat, and cauſes them to languiſh. The Symptoms of their Diſeaſe are a pale or yellow Colour in their Leaves, and a Ceſſation of Growth, and Death enſues as ſure as from a Dropſy.

The only Remedy to prevent this Diſeaſe in Plants, is to lay ſuch wet Land up into *Ridges*, that the Water may run off into the Furrows, and be convey'd by Ditches or Drains into ſome River.

The more a Soil is fill'd with Water, the leſs Heat it will have.

The two Sorts of Land moſt liable to be overglutted with Water, are Hills, whereof the *Upper Stratum* (or Staple) is Mould lying upon a *Second Stratum* of Clay.

And generally all ſtrong deep Land.

Hills are made wet and ſpewy by the Rain-Water which falls thereon, and ſoaks into them as into other Land; but being ſtop'd by the Clay lying next the Surface or Staple, cannot enter the Clay; and for want of Entrance, ſpreads it ſelf upon it; and as Water naturally tends downwards, it is by the incumbent Mould partly ſtop'd in its Deſcent, from the upper, towards the lower Side of an Hill; and being follow'd and preſs'd on by more Water from above, is forced to riſe up into the Mould lying upon it, which it fills as a Ciſtern does a Fountain (or Jette d'Eau). The Land of ſuch a Hill is not the leſs wet or ſpewy for being laid up in *Ridges*, if they be made from the higher to the lower Part of the Field; for the Force of the Water's Weight continued, will raiſe it ſo, as to cauſe it to iſſue out at the very Tops of thoſe *Ridges*: the Earth becomes a ſort of Pap or Batter, and being like a Quagmire, in going over it, the Feet of Men and Cattle ſink in till they come to the Clay; the upper Mould is near the Condition of the *Chaos inſtabilis Terra*.

There are two Methods of Draining ſuch a wet Hill: The one is to dig many Trenches croſs the Hill horizontally, and either fill them up with Stones looſe Arch-wiſe, through which the Water, when it ſoaks into the Trenches, may run off at one or both Ends of them into ſome Ditch which is lower, and carries it away: Then they cover the Trenches with Mould, and plough over them as in dry level Ground.

THIS Method has been found effectual for a Time, but not of long Continuance; for the Trenches are apt to be ſtop'd up, and then the Springs break out again as before: Beſides, this is a very chargeable Work, and in many Places, the Expence of it may almoſt equal the Purchaſe of the Land.

THEREFORE, 'tis a better Method to plough the *Ridges* croſs the Hill, almoſt horizontally, that their parting Furrows lying open, may each ſerve as a Drain to the *Ridge* next below it; for when the Plough has made the Bottom of theſe horizontal Furrows a few Inches deeper than the Surface of the Clay, the Water will run to their Ends, very ſecurely, without riſing into the Mould, provided no Part of the Furrows be lower than their Ends.

THESE parting Furrows, and their *Ridges*, muſt be made more or leſs Oblique, according to the Form and Declivity of the Hill; but the more Horizontal they are, the ſooner the Rain-Water will run off the Lands; for in that Caſe it will run to the Furrows, and reach them at right Angles, which they will not do when the *Ridges* (or Lands) are oblique; and therefore the Water's Courſe croſs the Lands will be longer. Every one of theſe horrizontal Trenches receives all the Water from the Rills or little Gutters wherein the Water runs betwixt the Mould and the Clay; theſe are all cut off by the Trenches, which receive the Water at their upper Sides, and carry it away, as the Trunks of Lead plac'd under the Eaves of a Houſe do carry away the Rain-Water.

IF there were no other Manner of ploughing *Ridges* on the Sides of Hills than what is commonly practiſed on the Plains, this Method of leaving open Furrows (or Drains or Declivites) would be impracticable; becauſe the Plough could not turn up the Furrows againſt the Hill and againſt the *Ridge* alſo, from the lower Side of it: But the eaſy Remedy againſt that Inconvenience, is to plough ſuch *Ridges* in Pairs, without throwing any Earth into the Trenches,

ches, and then the *Ridges* will be plain a-top, and the Rain-Water will run ſpeedily downward to the next Trench, and thence to the Head-land, and ſo out of the Field. Theſe Trenches will be made, as well as kept, always open by this ploughing in Pairs, and is abundantly more eaſy than the Way of ploughing *Ridges* ſingly. This ploughing in Pairs prevents alſo another Inconveniency which would otherwiſe happen to theſe horizontal *Ridges*; and that is, they being higheſt in the Middle, the Rain-Water could not run freely from the upper Half of a *Ridge* towards the next Furrow below it, but would be apt to ſink in there, and ſoak thro' the *Ridge*; but when *Ridges* lie in Pairs, the Water will run off from a whole *Ridge*, as well as off the lower Half of a *Ridge* that is plough'd ſingly, and higheſt in the Middle.

NOTE, That every Time of Ploughing, the Pairs muſt be changed, ſo that the Furrow, which had two (Lands or) *Ridges* turned towards it one time, muſt have two turned from it the next time: This Method keeps the Surfaces of all the *Ridges* (or Land) pretty near even, ſo that they may be drilled and *Horſe-houghed*, either length-ways, or croſs-ways. *

FARMERS are at more Trouble and Pains to drown ſuch Land (it being common to break their Horſes Wind in ploughing up Hill) than they would be at, if they laid their *Ridges* in the abovesaid Manner, which would effectually make them dry. Many hundred Acres of good Ground are ſpoiled; and many a good Horſe, in ploughing againſt the Hill, and againſt all Reaſon, Demonſtration, and Experience too, which might be learned even from the *Iriſh*, who drain their Bogs and make them fruitful, whilſt ſome *Engliſh* beſtow much Labour to drown and make barren many of their Hills, which would more eaſily by made dry and fertile.

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* *Note*, This cannot be done on a Hill, whoſe Declivity is ſo great, that the Plough is not able to turn a Furrow againſt it. But in this Caſe, perhaps, it may be ſufficient to plough the *Ridges* obliquely, enough for the Furrow to be turned both Ways.

I HAVE obſerved, that thoſe Places of ſuch a Hill, that when ploughed with the Deſcent, were the wetteſt, and never produced any thing that was ſown on them, became the very richeſt, when made dry by ploughing croſs the Deſcent. This ſhews that Water does not impoveriſh Land, but the contrary; though, whilſt it ſtands thereon, it prevents the Heat which is neceſſary to the Production of moſt Sorts of *Vegetables*: And where it runs ſwiftly, it carries much Earth away with it; where it runs ſlowly, it depoſites, and leaves much behind it.

THOUGH, in all Places where this Way of making the *Ridges* croſs the Deſcent of Hills is practiſed, the Land becomes dry, yet very few Farmers will alter their old Method; no, not even to try the Experiment; but ſtill complain their Ground is ſo wet and ſpewy, that it brings them little or no Profit; and if the Year prove moiſt, they are great Loſers by ſowing it. *

THE Benefit of laying up ſtrong deep Land into *Ridges*, is very great; though there be no Springs it, as are in the Hills aforementioned.

THIS Land, when it lies flat, and is ploughed in the *Virgilian* Manner, ſometimes one Way, ſometimes the other, by croſs ploughing, retains the Rain-Water a long time ſoaking into it; by that Misfortune, the Plough is kept out two or three Weeks longer than if the ſame were in round *Ridges*; nay, ſometimes its Flatneſs keeps it from drying till the Seaſon of Ploughing, and even of Sowing too, be loſt.

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* Remember, in making *Ridges* of all Sorts, and of whatſoever Figure the Piece is, that no *Ridge* ought to have any more Furrows at one End, than at the other End; for if there be, the Plough muſt be turned in the Midle of the Piece, which will cauſe the Land to be trodden by the Horſes; but if each End have an equal Number of Furrows, the Horſes, in turning, will tread only upon the Head-Lands, which may be ploughed afterwards; or if deſign'd to be Horſe-houghed, the Head-Lands ſhould be narrow, and not ploughed at all.

The Reaſons commonly given againſt ſuch *Ridges*, are theſe following.

I. They *prevent the fancied Benefit of Croſs-Ploughing.*

II. Farmers *think they loſe Part of their Ground, by leaving more Furrows betwixt* Ridges, *than when they lay their Land flat, where the Lands are made much larger than round* Ridges *can conveniently be: And becauſe, alſo, the Furrows betwixt* Ridges *muſt be broader, and lie open; but the other they fill up by the Harrows.*

The firſt of theſe I have already anſwered elſewhere, by ſhewing that Croſs-Ploughing is oftner injurious than beneficial.

The *Second*, I ſhall ſufficiently confute, if I can make appear that no Ground is loſt, but much may be gained by *Ridges*.

What I mean by gaining of Ground, is the Increaſing of the Earth's Surface; for if a flat Piece be ploughed up into *Ridges*, and if in each ſixteen Feet Breadth, there be an empty Furrow of two Feet; and yet by the Heighth and Roundneſs of the *Ridges*, they have eighteen Feet of Surface, capable of producing Corn equally to eighteen Feet, whilſt the Piece was flat, there will be one eighth Part of profitable Ground, or Surface, gain'd more than it had when level; and this, I believe, Experience will prove, if the Thing were well examined into.

But againſt this Increaſe of profitable Ground, there is an Objection, which I muſt not call a frivolous one, in reſpect to the Authors who bring it; yet, I hope, the Deſire of finding the Truth, will juſtify me to examine it, and the Arguments brought to ſuſtain it.

This Opinion of theirs, is founded upon their Notion (which, I think, very erroneous) of the Perpendicular Growth of *Vegetables*, and is, by Mr. *Bradley*, ſet in its beſt Light, in his *Vol.* I. *Page* 8. *uſque ad Page* 13. and in his Cut, repreſenting three Hills; but his Arguments ſeem to be ſuch, as all Arguments are, which pretend to prove a Thing to be what it is not, *viz.* Sophiſtical ones.

The Hypotheſis he endeavours to prove, is in *Page* 8. thus: "A Hill may contain four equal "Sides, which meet in a Point at the Top; but the "Contents of theſe four Sides, can produce no more, "either of Grain or Trees, than the plain Ground, "upon which the Hill ſtands, or has its Baſe; and "yet, by the Meaſure of the Sides, we find twice "the Number of Acres, Roods, and Poles, which "meaſures in the Baſe, or Ground Plat; and there-"fore, *Page* 9. Hills are worth no more than half "their Superficial Meaſure; *i. e.* two Acres upon "the Side of the Hill to pay as much as one upon "the Plain, provided the Soil of both is equally "rich."

To prove it, he gives an Example in *Fig.* III. of Buildings upon a Hill; ſhewing, that the two Sides of the Hill will only bear the ſame Number of Houſes, that may ſtand in the Line at the Baſe.

This is foreign to the Queſtion, of how much Grain, or how many Trees, the Hill will produce. For *Vegetables* being fed by the Earth, require much more of its Surface to nouriſh them, than is neceſſary for them to ſtand on; but Buildings require no more of the Surface but Room to ſtand on: Therefore, no ſuch Argument, taken from Buildings, can be applied to *Vegetables*.

This Argument of Mr. *Bradley*'s, gives no more Satisfaction to the Queſtion, about producing of *Vegetables*, than a Grazier would do, being asked, how many Oxen a certain Paſture Ground would maintain, if he ſhould anſwer, by ſatisfying you with the Number of Churches which might ſtand thereon.

THE like Anſwer, in Effect, may be given to the Argument in *Fig*. IV. of the Pales, only he has forgot to ſhew, that to mound over the Hill would require double the Rails, or double the Hedge-wood (except Stakes) as to mound the Baſe; if it did not, the Hill would be yet of the more Value, becauſe thereon more Surface migh be fenced in at leſs Expence.

IN his *Fig*. II. he gives no good Reaſon why the Hill ſhould not bear twice the Number of Trees as the Baſe can do; for there is as much Room for two hundred Trees on the Hill, as for one hundred on the Baſe, becauſe he allows the Surface to be double to that of the Baſe. He ought to meaſure the Diſtances of the Trees on the Hill, by a Line parallel to the Surface they grow on, as well as he does the Diſtances of thoſe below.

AND ſuppoſe the Row at the Baſe, together with the Surface they grow on, were rais'd up, ſo that it ſhould become parallel to Half the Row on the Hill, Would not the Trees in the Baſe Row be twice as near to one another as the Trees in the Hill Row are? And ſuppoſe a Line had been ty'd from the Tops of all the lower Trees before the Row was ſo rais'd up at one End, and then after the Situation of the Row was ſo alter'd, if by this Line the Trees ſhould be pull'd from being perpendicular to the Surface they grow on, and made to ſtand oblique to that, and perpendicular to the Horizon, as the upper Trees are, Would the Diſtances of the Trees from one another be alter'd by this Change of Poſture? No, for their Bottoms would be at the ſame Diſtances, becauſe not removed; and their Tops, becauſe the ſame Line holds them, at the ſame Diſtances in both Poſtures.

MR. *Bradley*'s Lines, drawn from the Trees below, which are one Perch aſunder, makes the two Rows of Trees, falſely, ſeem to be at equal Diſtances, becauſe theſe Lines are parallel to each other: But this is a Deceit; for, in Truth, the Diſtances of the Trees are not meaſured by the Diſtances of thoſe Lines, but by the extreme Points at the Ends of the Lines; * and thoſe two Points above, where the Lines cut the Row obliquely, and at unequal Angles, are twice as far aſunder as the endmoſt or extream Points below are, where the Lines cut the Row at Right Angles. Hence may be inferr'd, that there is Room for twice as many Trees to grow on the Hill as on the Baſe, and twice as much Grain for the ſame Reaſon, and becauſe there is twice the Surface for the Roots to ſpread in. And ſince Mr. *Bradley* allows the Hill to contain two Perches to one of the Baſe, and the Soil of both to be of equal Goodneſs, and yet, affirms, that the two can produce no more of Grain or Trees, than the one Perch can; I cannot ſee, why it ſhould not be as reaſonable to ſay, That two Quarters of Oats will maintain a Horſe no longer, nor better, than one Quarter of Oats, of equal Goodneſs, will do.

In *Page* 13. He concludes thus: "That Hills, "in their Meaſure, contain only as much profitable "Land as the Plain or Plat of Ground they ſtand "upon; and as a Proof of that, all *Vegetables* or "*Plants* have an erect Method of Growth."

This Proof of Mr. *Bradley*'s is founded upon an Argument which has no Conſequence, unleſs it firſt proved, that the Surface of Earth could produce and maintain as many *Vegetables* or *Plants* as could ſtand thereon in an erect Poſture; which Suppoſition is as impoſſible, as that half an Acre ſhould produce and maintain a Hecatomb, without Mr. *Bladley*'s teaching Oxen to live upon Air for their Food, as he thinks *Van Helmont's* Tree did.

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* Theſe upper Trees are meaſured by the unequal Length of the Lines, not by their Parallel Diſtance, as the lower Trees are; therefore his Meaſure is a Quibble.

All expert Husbandmen muſt needs be convinced, that the greateſt Crop of *Vegetables* that ever grew, might ſtand in an erect Poſture, upon a twentieth (and I may ſay the hundredth) Part of the Surface that produced it; therefore, there muſt be nineteen Parts (for the Roots to ſpread) unoccupied by the Trunks, Stems, or Stalks.

And though it be true, that a Hill will ſupport no more of theſe (than its Baſe) when placed in an erect Paſture cloſe together, as in a Sheaf; yet, this cloſe Poſition is only proper for them when they are dead, and require no more Nouriſhment than Houſes and Pales do; and conſequently require no Room but to ſtand on. Therefore, this Argument of Mr. *Bradley's* muſt not be admitted in Vegetative Growth, where there is always required nineteen times more Room in the Surface, for the Uſe of the Roots, than what the Stems, Trunks, or Stalks, do poſſeſs upon it: And the more Room there is for the Roots, the greater Number of Plants may be produced.

Neither can I admit, that all *Vegetables* or *Plants* have an erect Method of Growth; becauſe the contrary is ſeen in Chamomile, and divers other *Vegetables*, which have an Horizontal Method of Growth.

But what is more material to this Purpoſe, to be obſerved, is, that all *Vegetables* have Horizontal Roots, and Roots parallel to the Earth's Surface or Superficies; and unleſs thoſe Roots have a ſufficient Superficies of Earth to range in, for the Nouriſhment of a Plant, the Stem and Branches cannot proſper, whatever by their Method of Growth above the Earth; and if there be not a due Quantity of Food for the Roots, within the Earth, a very little Space may contain the external Parts of *Vegetables* upon it.

From what has been ſaid, I think, we may conclude, That Mr. *Bradley's* Hill may produce more

Vegetables than the Baſe whereon it ſtands; and therefore, it is of more Value than half its ſuperficial Meaſure, *i. e.* Two Acres on the Hill is worth more than one Acre on the Plain, the Soil being equally rich, as he allows it to be, in his Caſe.

NOW, indeed, whether Mr. *Bradley* might not poſſibly be deceived in his Opinion, of the equal Richneſs of his Hill and his Plain, I will not diſpute; I will only ſay this, that 'tis generally otherwiſe. But where a Plain is ploughed up into moderate *Ridges*, their Heighth being in Proportion to the Depth of the Staple, below which the Plough muſt take nothing into the *Ridges*, the Soil is equally rich, whether it be ploughed plain or ridged up. And as the Surface is in the *Ridges* increaſed, there is nothing, in all Mr. *Bradley*'s Arguments, that ſhews, why that increaſed Surface ſhould not produce more *Vegetables* than the ſame Earth could do whilſt it was level.

THERE are other Reaſons why it ſhould produce more when Ridged, beſides the Increaſe of Surface; as,

I. 'TIS *then more free from the the Injuries of too much Water.*

II. 'TIS *better protected againſt cold Winds; becauſe the* Ridges *are a Shelter to one another.*

III. IF *the Surface be much exhauſted, by too frequent Sowing, the* Ridges *may be made juſt where the Furrows were, and then the Surface will be intirely changed.*

THE following general Rules ought to be obſerved about *Ridges*, viz.

THAT as to their Heighth, Regard muſt be had to the Nature of the Soil, in its difficult Admiſſion of Water; for the greater that is, the greater Declivities the *Ridges* ſhould have; and then, if the Soil be not deep, they ſhould generally be made the narrower.

There is one Thing which Mr. *Bradley* takes no Notice of, *viz.* That no more of the Rain or other Benefits of the Atmoſphere, which deſcend perpendicularly, can fall on a Hill, or on a Ridge, than what would fall on the Baſe, or Ground Plot. But, 'tis probable, that more of the fine Vapour, which, ſwims in the Current of the Air horizontally, does ſtrike and break againſt thoſe Eminences, and ſo make an Equivalent; * except that it runs off more quickly.

Notwithstanding all I have here ſaid, in behalf of *Ridges*, I muſt confeſs, that for my *Houghing-Husbandry*, I ſhould prefer Land that is naturally dry enough, without a Neceſſity of being laid up in any larger or higher *Ridges* than what may contain ſix Feet in Breadth, that Size being the largeſt that is proper for the regular Operation of the *Horſe-Hough*; whether the Rows be double, treble, or quadruple,

Of PLOUGHS.

By what Means *Tillage* it ſelf came at firſt to be invented, is uncertain; therefore we are at Liberty to Gueſs: And it ſeems moſt probable, that it was (like moſt other Inventions) found out by Accident, and that the firſt Tillers (or Ploughers) of the Ground, were Hogs: Men in thoſe Days having ſufficient Leiſure for Speculation, obſerv'd, that when any Sort of Seed happen'd to fall on a Spot of Ground well routed up by the Swine, (whom Inſtinct had inſtructed to dig in Search of their Food) it grew and proſpered much better than in the whole unbroken Turf. This

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* But though *Ridges* do alter or increaſe the Surface, the Quantity of Soil or Earth remaining the ſame as on the Level, and of no greater Depth than can be Tilled, it may produce equal Crops of Corn with the Level, and no more; except from the Advantage the *Ridges* may give it in lying drier,

Obſervation muſt naturally induce rational Creatures to the Contrivance of ſome Inſtrument, which might imitate, if not excel Brutes in this Operation of breaking and dividing the Surface of the Earth, in order to increaſe and better its Product.

THAT ſome ſuch Accident gave Men the firſt Hints of *Original Agriculture*, may be inferr'd from the very little (or no) Probability of its being invented originally upon Arguments which might convince the Underſtanding (by juſt Concluſions from Ideas of the Earth and Vegetation) of any reaſonable Grounds to hope that the Effect of increaſing the Earth's Produce, ſhould follow the *Cauſe of Tillage*; or, in other Words, Why it ſhould produce more when Tilled, than when Untilled. Therefore, 'tis very unlikely that Men ſhould *Begin* to take Pains to Till the Land, without any ſort of Reaſon why they did it. And no ſuch Reaſon could they have, before the Invention, as they had afterwards. For when they *Accidentally* ſaw that *Effect* follow that *Cauſe*, then they were well convinced it did ſo. But tho' this Argument, *viz. Tillage* increaſes the Product of the Earth *becauſe it does*, has been ſufficient to continue the Practice of *Tillage* ever ſince; yet 'tis impoſſible for the Inventors to have had this Argument before the Invention, in Caſe it had been invented by Men, and not fortuitouſly diſcover'd.

HAD there ever been extant any other, or *Better Arguments* whereon this Practice, ſo uſeful to Mankind, was founded; ſure, ſome of all the Great and Learned Authors, who have writ on this Subject, would have mention'd them. Philoſophers, Orators, and Poets have treated of it in the ſame Theory by which it was firſt diſcover'd, and by no other, *viz.* Land produces more when Tilled; and ſome ſeem to ſay, the more 'tis Tilled, the more it produces. It does, *becauſe it does*; not a Word of the Paſture of Plants, or any thing like it. So that all the ancient *Scriptores de Re Ruſticâ* have done, was only to keep that Theory in the ſame Degree of Perfection in which the firſt Diſcoverers received it.

THE briſtled Animals broke up the Ground, becauſe they uſed to find their Food there by Digging; Men Till it, becauſe they find *Tillage* procures them better Food than Acorns,

THE Reaſons are the ſame for one and the other.

THESE Writers, aſham'd to acknowledge ſo noble a Diſcovery to be owing to ſo mean a Foundation, make no Mention of the true Teachers, but attribute the Invention to *Ceres*, * a Goddeſs of their own making; ſhe, as they pretend, firſt taught the Art of *Tillage*. With this Fable they were ſo well pleaſed, that they never attempted to improve that Art, leſt they ſhould derogate from the Divinity of *Ceres*, in ſuppoſing her Invention imperfect.

WITH what Inſtrument Men firſt Tilled the Ground, we don't know exactly; but there may be Reaſons to belive it was with a Spade, and probably a wooden one, and very rough.

FOR whilſt People liv'd on Acorns, there was no Uſe of the Smith, ſuch Food required no Knives for eating it, nor was it worth while to make Swords to fight for it; and without Iron the Spade could not be well hewn, or ſhap'd; but if it had been ſuch as it is at preſent, there never was any thing comparable to it, for the true Uſe of *Tillage*. Yet the Spade could not make that Expedition, which was neceſſary when *Tillage* became general in the Fields;

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* They did well indeed, to impute the Invention to a Woman; becauſe the Reaſons whereon it was founded, were unbecoming of a Man: Being without Principles, it could not (likely) be improved, unleſs ſome Mathematical ones were diſcover'd.

They were very Unjuſt, to give the Reputation of Inventrix of *Tillage* to *Ceres*, who could be no better than a Plagiary, and make poor *Cicely*, from whoſe Family ſhe ſtole it, fall a Sacrifice to her Alter, as the *Porca Pracidanea* did, amongſt the *Romans*. But Swine had practiſed the Art of Turning the Soil, and ſo had Men, long before the fictitious Deity of *Ceres* was invented.

and therefore in time the Spade came wholly to be appropriated to the moſt perfect Sort of *Tillage* in the Garden. Then the *Plough* ſupply'd the Place of the Spade in the Field; and tho' it could not (ſuch as it was) Till the Land near ſo well, yet it could Till ten-times more of it, and with leſs human Labour.

WHY they did not Improve the *Plough*, ſo that it might alſo Till as well as the Spade, ſeems owing to their Primitive Theory, which gave no Mathematical Reaſon to ſhew wherein the true Method of *Tillage* did conſiſt, *viz.* in dividing the Earth into many Parts, to increaſe its internal Superficies, which is the Paſture of Plants.

THE Difference betwixt the Operation of the Spade and that of the common *Plough*, is only this: that the former commonly divides the Soil into ſmaller Pieces, and goes deeper.

HOW eaſy and natural it is to contrive a *Plough* that may equal the Spade, if not exceed it, in going deeper, and cutting the Soil into ſmaller Pieces, than the Spade commonly does, I leave to the Judgment of thoſe who have ſeen the Four-coulter'd *Plough*.

THE *Plough* deſcrib'd by *Virgil* had no Coulter; neither do I remember to have ſeen any Coulter in *Italy*, or the South of *France*; and, as I have been inform'd, the *Ploughs* in *Greece*, and all the *Eaſt*, are of much the ſame Faſhion; neither is it practicable to uſe a Coulter in ſuch a *Plough*; becauſe the Share does not cut the Bottom of the Furrow horizontally, but obliquely; in going one way, it turns off the Furrow to the Right Hand, but in coming back, it turns it to the Left; therefore, if it had a Coulter, it muſt have been on the wrong Side every other Furrow: And beſides, as the Handle (for it has but one) always holds the *Plough* towards one Side, with the Bottom of the Share towards the unplough'd Land, it would cauſe the Coulter to go much too low when it went on the Furrow Side, and it would not touch the Ground, when it went on the Land Side.

'Tis a great Miſtake in thoſe, who ſay, *Virgil's Plough* had two Earth-Boards, for it had none at all; but the Share it ſelf always going obliquely, ſerv'd inſtead of an Earth-Board, and the two Ears which were the Corners of a Piece of Wood lying under the Share, did the Office of Ground-Wreſts: This Faſhion continues to this Day in thoſe Countries, and in *Languedoc*.

This Sort of *Plough* performs tolerably when Ground is fine, and makes a ſhift to break up light Land; and I could never find any other Land there: I am ſure, none comparable to ours for Strength; and it would be next to impoſſible, to break up ſuch as we in *England* call *Strong Land*, with it.

I do not find, that the Arable Lands about *Rome* are ever ſuffered to lie ſtill long enough to come to a Turf; but I have obſerved in the low rich Lands in the *Calabria's*, ſubject to the Invaſions of the *Turks*, that there is Turf, and that theſe *Ploughs* go over the Land two or three times before the Turf of it is all broken, tho' the Soil be a very mellow Sort of Garden-Mould. Having no Coulters to cut it, they break and tear the Turf into little Pieces. This was done in the Month of *November*; and had I not ſeen Men and Oxen at the Work, or had there been Oaks in the Place, I ſhould rather have thought, that *Tillage* performed by a Race of the firſt Teachers of it, in muzzling Acorns, than by *Ploughs*. However, the Mould being naturally very mellow, when the Turf is broken with ſhallow Ploughing, they can plough deeper afterwards.

The *Engliſh Ploughs* are very different from the *Eaſtern*, as in general the Soil is.

These when well made, cut off the Furrow at the Bottom horizontally; and therefore, it being as thick on the Land Side, as on the Furrow Side, the *Plough* cannot break it off from the whole Land, at ſuch a Thickneſs (being ſix-times greater than the *Eaſtern Ploughs* have to break off,) and muſt of Neceſſity have a Coulter to cut it off; by this Means the Furrow is turn'd perfectly whole, and no Part of the Turf of it broken; and if it lie long without new Turning, the Graſs from the Edges will ſpread and form a new Turf (or Swerd) on the other Side, which was the Bottom of the Furrow before Turning, but is now become the Surface of the Earth, and may ſoon become greener with Graſs than before Ploughing; and often the very Roots ſend up new Heads to help ſtock the reverſed Furrow, the former Heads being converted into Roots, ſo that 'tis doubly cloathed and braced on both Sides, or, as it were, kay'd together, firm and ſolid, almoſt as a Plank; it may be drawn from one Side of a Field to the other, without breaking, and might poſſibly be made Uſe of, inſtead of *Virgil's Crates Viminea*, for harrowing or ſmoothing of fine Till'd Ground; but not without much Time, Labour, and Difficulty can it be made ſuch it ſelf.

IF you Plough whole ſtrong turfy Furrows croſsways, as *Virgil* directs, and as it is too commonly practiſed, the Coulter cannot eaſily cut them, becauſe, being looſe underneath, they do not make a ſufficient Reſiſtance or Preſſure againſt its Edge, but move before it, and ſo are apt to be drawn and driven up into Heaps, with their Surfaces lying all manner of Ways, and ſituate in all manner of Poſtures: So the Turf, which is not turned, continuing in the open Air, grows on, and with its vigorous Roots, holds the Earth faſt together, and will not ſuffer the neceſſary Diviſion to be made, which would be, if the Turf were rotten, and which is the End of all *Tillage*, viz. to increaſe the Paſture of Plants.

NEXT, ſome have vaſt heavy Drags, with great long Iron Tines in them; and though theſe huge broken Pieces of Furrows being looſer than before, require keener Edges to cut them; yet theſe Drag-Tines have no Edge at all, but are as blunt as the Furrows they ſhould cut. Theſe Drags draw them ſometimes into larger Heaps, leaving the *Under-Stratum* bare betwixt them, only ſhaking off ſome of their Mould in tumbling them about, and ſcratching their Surfaces, without reducing them to a moderate Fineneſs, until this ill-broken Land has, for above a Year, and ſometimes longer, entertained Ploughs, Cattle, and Men, with a frequent laborious Exerciſe, for which they are obliged to the one Coulter. If the Soil be ſhallow, it may be broke up with a narrow Furrow, which will the ſooner be brought in Tilth.

BUT if it be a deep Soil, the Furrows muſt be proportionably large, or elſe a Part of the good Mould muſt be left under unmoved, and ſo loſt; for a *narrow* Furrow cannot be ploughed deep, becauſe the *Plough* will continually ſlip out from the hard Land towards the Right-Hand, unleſs the riſing Furrow be of ſufficient Weight to preſs the *Plough* towards the Left, and keep it in its Work: The deeper you Plough, the greater Weight is required to preſs it; ſo that the deeper your Land is, the worſe (or into the larger Furrows) muſt it be broke up with one Coulter, inſomuch, that if the Land be ſtrong, (as moſt deep Ground in *England* is) 'tis a Work of ſome Years to conquer it, after it has been reſted. And often it happens, that the exceſſive Charge of this *Tillage* reduces the Profit of rich Land below that of much poorer.

THIS gives an Opportunity to deceitful Servants, of impoſing upon their ignorant Maſters. They Plough ſuch deep Land with a ſmall ſhallow Furrow, to the End the Turf and Furrows may be broken, and made fine the ſooner; pretending they will plough it deeper the next time (which is called Stirring) which theſe Rogues know very well cannot be done, and intend no more than that, the *Plough* coming the eaſier after the Horſes, their Coats may ſhine the better; and though there be no Crop at Harveſt, they muſt have four Meals a Day, all the Year, and extravagant Wages at *Michaelmas*, or at any time of the Year, when they think fit to miſ-behave themſelves.

This Sort of Land muſt not be ſtirred, *i. e.* ploughed the ſecond time in wet Weather, for that will cauſe the Graſs and Weeds to multiply, beſides the treading the Ground into hard Dabs, *&c.* And in dry Weather, the *Plough* will never enter any deeper than it went the firſt time, the Reſiſtance below being ſo much more than the Preſſure above, the *Plough* will riſe up continually; or if it goes deep enough for the Weight of Earth to keep it down, another Inconvenience will follow, which is that mentioned by *Columella*, *Page* 47. *Quod omnis humus quamvis lætiſſima, tamen inferiorem partem jejuniorem habet, eamque attrahunt excitatæ majores Glebæ; quo evenit, ut infœcundior materia miſta pinguiori ſegetem minus uberem reddat.* The vulgar *Engliſh* Phraſe is, It *Spaults* up from below the Staple. Hence the treacherous Ploughman is ſecure of an eaſy Summer's Work, if he can perſuade his Maſter to ſuffer him to fallow the Ground with a ſhallow Furrow.

Another way to conquer a ſtrong Turf, is, to plough it firſt with a *Breaſt-Plough*, very thin; and when the Swerd is rotten, then plough it at the proper Depth: But this Method is (beſides the extraordinary Charge of it) liable to other great Misfortunes. If the Turf be pared up in Winter, or early in the Spring, 'tis a Chance but the Rains cauſe it to grow ſtronger than before, inſtead of its Rotting.

And if it be pared later, though dry Whether do follow, and continue long enough to kill the Turf, yet this loſes Time, the Seaſon of Ploughing is retarded, for all the Staple ſtill remains untill'd, and before that can be well done, the Year is too far ſpent for ſowing it with Wheat, which is the moſt proper

Grain for ſuch ſtrong Land, * and few will have Patience to wait, and plough on till another Wheat-Seed Time. The dry Weather alſo, which in the Summer kills the Sword, renders the Ploughing obnoxious to moſt or all the Evils aforementioned.

A Farmer enquires concerning the *Four Coulter Plough*, as in the following *Dialogue*,

Farm. What muſt we do then? Muſt we have Recourſe to the Spade for breaking up our rich, ſtrong, ſwerdy Land?

Reſp. If you can procure Men to dig it faithfully in Pieces, not above two Inches and a half thick, at the Price of about eight Shillings *per* Acre, it would do very well, and anſwer all the Ends of *Tillage*; but though you bargain with them to dig it at that Size for three Pounds *per* Acre, you will find upon Examination, moſt of the Pieces or Spits, which are dug out of your Sight, to be of twice that Thickneſs. And no great Quantities can be this way managed, although the Price of Corn ſhould anſwer ſuch an extravagant Expence.

Farm. Since 'tis ſo difficult to bring our ſtrong Land into Tilth, after it has reſted, that it cannot be ſpeedily done by a *Plough* without a Coulter, or by one with a Coulter, in wet Weather or dry, nor with a *Breaſt-Plough*, without a certain Expence, and an uncertain Succeſs, the Spade is too chargeable a *Tillage* for the Field: It ſeems to me, upon the whole, that we are Loſers by this *Inaratæ gratia Terræ*, unleſs we could contrive ſome other Method of reducing it ſooner, and with leſs Charge, into Tilth; for, I obſerve, that when we ſow it upon the Back, the Corn and Graſs (or Couch) coming both together, exhauſt the Ground ſo much, that by that time we can (which is about three Years) reduce the great Lumps to a tolerable Fineneſs, it grows full of Graſs and Weeds (which we call Foul) and loſes that Fertility we expected it ſhould acquire by Reſt, becoming, in our Terms, both out of Tilth and out of Heart.

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* Beſides, moſt ſtrong Land has Stones in it, which will not admit the Uſe of the *Breaſt-Plough*.

Reſp. IF you know all this to be true, and that, without a Coulter you cannot break it up at all; and that, with one Coulter you cannot any way cut the Furrow ſmall enough, or leſs than ten Inches broad; why do not you cut it with four Coulters, which will reduce the ſame Furrow into four equal Parts, of two Inches and a half each in Breadth, and of the Depth of the Staple, though that ſhould be two Spit, or ſixteen Inches deep.

Farm. HOW can that be done?

Reſp. EVERY Jot as eaſily as with one Coulter. For before the Furrow is raiſed by the Share, it lies faſt, and makes a ſufficient Reſiſtance equally againſt the Edges of all the Coulters, though after it be raiſed and looſe, it yields and recedes every way, except downwards, ſo that it cannot be cut by any Edge, but ſuch as attacks it perpendicularly from above, as that of the Spade does.

Farm. THIS ſeems, to me, reaſonable, and having very lately heard Talk of this *Plough*, I would gladly know more of it.

Reſp. THE Furrow being cut into four Parts, has not only four-times the Superficies on the eight Sides, which it would have had on two Sides; but it is alſo more divided croſs-ways, *viz.* The Ground-wriſt preſſes and breaks the lower (or Right-Hand) Quarter; the other three Quarters in riſing and coming over the Earth-Board, muſt make a crooked Line about a Fourth longer than the ſtrait one they made before moved; therefore, their Thinneſs not being able to hold them together, they are broken into many more Pieces, for want of Tenacity to extend to a longer Line, contrary to a whole Furrow, whoſe great Breadth enables it to ſtretch and extend from a ſhorter to a longer Line, without breaking, and as it is turn'd off, the Parts are drawn together again by the Spring of the Turf or Swerd,* and ſo remain whole after Ploughing. Thus the Four-coulter'd *Plough* can divide the Soil into above twenty times more Parts than the common *Plough*; and ſometimes when the Earth is of a right Temper betwixt wet and dry, the Earth-Board, in turning the Furrows off, will break them into Duſt, having more Superficies than is made by four common Ploughings; and it is impoſſible there ſhould be any large Pieces amongſt it.

NOW, What a prodigious Advantage muſt the Influences of the Atmoſphere have upon theſe ſmall Parts, for making a further Diviſion of them? Froſt, Water, Drought, and nitrous Air eaſily penetrate to their very Centers, which cannot in the largeſt of them be more than one Inch and a Quarter diſtant from their Superficies. This Advantage, with a few ſubſequent common Ploughings perform'd in proper Seaſons, reſolves the Earth almoſt all to a Powder. The Swerd, ſome being immers'd or bury'd and mix'd among ſo great a Proportion of Mould, is ſoon rotten and loſt, ſome of the Swerd lying looſe a-top, the Earth preſently drops out of it, and then the Roots are dry'd up, and die. Thus is the whole Staple of the Ground brought into perfect Tilth in a very ſhort time beyond what the Spade ever does in ſuch ſwerdy Land.

Farm. WHAT Sort of Weather is beſt for uſing this *Plough?*

Reſp. ANY Weather, except the Ground be ſo dry and hard, that the *Plough* cannot enter it; but 'tis very proper to be done, when the Earth is ſo wet, that by no means it ought to be ploughed with any other *Plough*; for it never can be too moiſt for this, unleſs the Cattle which draw it, be mired: becauſe though all the Cattle ſhould not go in the Furrow, yet their Treadings are cut ſo ſmall by the Coulters, that the Earth is not kept from diſſolving, as when turn'd off whole in common *Tillage*. 'Tis obſerved, that the Inciſions made by the Coulters on ſwerdy Land, will not heal or ſo cloſe up, but that they will open again by the next Ploughing, though it be a Twelve-month after. A Farmer who uſes this *Plough*, may till in all Weathers, and all Seaſons of the Year, either in Fallowing with this, which is beſt in wet, or in ſtirring with the common ones, which muſt be done in dry Weather*; and when the Ground is broke up with this, it may be ſtirr'd in the drieſt Weather that can be, without the Danger of tearing (or ſpaulting) up of the *Under-Stratum* along with the Staple, becauſe this is all broken before, and then no more can riſe with it; as it does to the Ruin of the Soil, when in common *Tillage* they go deeper the ſecond time than the firſt; alſo, if there be a Neceſſity of ſtirring ſome Sort of Land when 'tis wet, it ought either to be done with this *Plough*, or elſe with a common one drawn by a ſingle Row of Cattle treading all in the Furrow; for though ſome Land be very fine, yet, when otherwiſe plough'd in wet Weather, it will be made into large Pieces by the treading, and perhaps not diſſolve again in a long time, therefore 'tis better to be prevented.

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* A ſwerdy Furrow cut off by only one Coulter, being whole, is apt to ſtand up on its Edge, or lie hollow, and then being open to the Air, it does not Rot; but when it is cut by ſeveral Coulters, it has not Strength to ſupport it ſelf, it falls down, lies cloſe to the Earth under it, and excluding the free Air from the Turf, it ſoon becomes rotten.

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* In this Way of Ploughing, there's no need to obſerve the critical Day of the Moon, nor whether ſhe be increaſing or decreaſing, neither what Wind blows, as *Virgil* ſo dogmatically enjoins to be preciſely obſerved; and ſome of the Ancients preſcribe the very hour of the Day, beſides innumerable Degrees of wet and dry Weather, ſo that without all theſe Accidents meet, they tell us we muſt abſtain from Ploughing. Our Ploughmen would be glad their Maſters were as Superſtitious, for then the *Plough* might keep Holidays enough. But far from all this, we do not even obſerve at what Time of the Sun's Courſe, we Till our Land in, and find it always ſucceeds beſt when the Soil can be broken into moſt Parts, without having any other Regard to Sun, Moon, Wind, or Weather; This *Plough* prevents the Injuries of them all.

Farm. I perceive this *Plough* lays the Foundation for all good *Husbandry*; and there can be no other way to bring Land into perfect Tilth in ſo ſhort a Time, or with ſo little Expence. And I am convinc'd, that no Farmer ought to be without it, who deſires to be free from the Danger of his Land being ever out of Tilth; but I have heard it objected, that it is harder to draw than the common *Ploughs*: And that its Beam being longer, upon account of the four Coulters, it lies farther behind, and comes harder after the Horſes.

Reſp. I muſt confeſs, there is ſomething in that Objection; for that *Plough* being ſomething longer, may be a little the harder Draught, and alſo its Weight and Strength muſt bear a Proportion to the Length of it. But this ſmall Increaſe of the Draught would have been a much ſtronger (if not a fatal Objection, had that Cuſtom been general, of Horſes drawing by their Tails, as 'tis ſaid to have been formerly in ſome Places; for then, perhaps, a ſufficient Strength of Horſes could not be applyed to the *Plough*. But in Countries where Traces are in Uſe, every Horſe of the Team may draw the *Plough* equally, and then there will be no other Inconvenience, beſides the adding one Horſe, or keeping a ſtronger Team: And he cannot be wiſe, who would loſe the Profit of his Land, for the Odds of ſometimes adding a Horſe to his *Plough*. And I am very certain, that this *Plough* requires a much leſs Strength of Cattle to draw it, in the moiſt Weather, which is the moſt proper to uſe it in, than to draw a common *Plough* in the ſame Ground, and at the ſame Depth, in dry Weather; and can ſeldom be uſed ſafely in any other. And the Vulgar, who have always a wrong Cauſe ready at Hand to apply to every thing, impute that Draught to the Faſhion of the *Plough*, which ought to be imputed to its going deeper; and this great Depth at which 'tis capable of Ploughing, *viz.* Two Spit deep is one extraordinary Benefit of it, though it may, on Occaſion, go as ſhallow as any.

THE Draught is not ſo much increaſed by adding three Coulters, as may be imagined; for when the Ground is moiſt, the Inciſions are eaſily made by the Edges; and when they are cut ſmall, the Furrows riſe much more eaſily upon the Share and Earth-Board, than if whole.

Farm. IF this *Plough* be ſo beneficial, having ſo many Advantages, and only the two Inconveniencies, one of requiring a little more Strength to draw it, and the other its being unfit for dry hard Ground, I wonder why it is not become more common?

Reſp. IT has been uſed with very great Succeſs for theſe ſeveral Years laſt paſt, but never like to be common, unleſs it be deſcribed in a more Geometrical Manner, than any *Plough* has hitherto been; for the *Plough-wrights* find it difficult enough to make a common *Plough* with one Coulter to perform as it ought, for want of the neceſſary Rules of their Art. 'Tis upon this Account that the two-coulter'd *Ploughs* are uſed in few Places, tho' they have been found of excellent Uſe, and have been formerly common: But, alas! when the Makers, who by their diligent Study and much Practice had attained the Perfection of their Art, for want of learning to write their Rules mathematically, and ſhew how the mechanical Powers were applicable to them, the Art was in a manner loſt, at the Death of thoſe Artiſts; and then the unskilful *Plough-wrights*, deſtitute of the true Rules, were not able to make a two-coulter'd *Plough* to perform well, and then it was left off. Very lately 'tis revived, ſince the three and four-coulter'd ones have been uſed; from whence ſome have made a ſhift to take the Rules of placing two Coulters into a *Plough*, and they begin to be common again; and, no doubt, will ceaſe again as ſoon as the Rules are forgot.

'TIS ſtrange that no Author ſhould have written fully of the Fabrick of *Ploughs!* Men of greateſt Learning have ſpent their Time in contriving Inſtruments to meaſure the Stars, and in finding out the Dimenſions, and even Weight of the Planets: They think it more eligible to ſtudy the Art of Ploughing the Sea with

Ships, than of Tilling the Land with *Ploughs*; they beſtow the utmoſt of their Skill, learnedly, to pervert the natural Uſe of all the Elements for Deſtruction of their own Species, by the *Bloody* Art of War. Some waſte their whole Lives in ſtudying how to arm Death with new Engines of Horror, and inventing an infinite variety of Slaughter; but think it beneath Men of Learning (who only are capable of doing it) to employ their learned Labours in the Invention of New (or even improving the Old) Inſtruments for increaſing of Bread.

THE eaſieſt Method of perpetuating the Uſe of the many-coulter'd *Ploughs*, and other newly-invented Inſtruments of *Husbandry*, is by Models, *i. e.* the Things themſelves in Little, and theſe may be all portable even in a Man's Pocket: Every Part muſt be fully deſcrib'd, with the true Dimenſions, and the Mathematical Reaſons on which their Contrivance is founded: Directions alſo for uſing them muſt be given at the ſame time that their Manner of making is deſcrib'd. In ſome, the very Horſes which draw, muſt be repreſented, to ſhew the Manner of Fixing the Horſes and the Traces: Cautions againſt all the Errors that may happen by the want of Experience in the Makers or Uſers, muſt be given.

WHEN this is done, and the Rules put into a Method, the *New Houghing Husbandry*, in all its Branches, will be much more eaſy and certain than the *Old*; becauſe there are no Mathematical Rules extant in any Method; and a Man may practiſe the old random Husbandry all his Life, without attaining ſo much Certainty in *Agriculture* as may be learn'd in a few Hours from ſuch a Treatiſe.

THE Rules, indeed, require much Labour, Study, and Experience to compoſe them; but when finiſh'd, will be moſt eaſy to practiſe: Like the Rules for meaſuring Timber; their Uſe is, at firſt Sight, eaſy to every Carpenter, and to moſt Artificers who work in Wood, but no illiterate Perſon is able to compoſe thoſe Rules, or to meaſure Timber without them.

Of DIFFERENCES

BETWEEN THE

Old and the *New Husbandry*.

IN order to make a Compariſon between the *Houghing Husbandry*, and the *Old Way*, there are four Things; whereof the Differences ought to be very well conſidered.

I. *The Expence* II. *The Goodneſs* III. *The Certainty*	of a Crop.

IV. *The Condition in which the Land is left after a Crop.*

THE Profit or Loſs ariſing from Land, is not to be computed, only, from the Value of the Crop it produces; but from its Value, after all Expences of Seed, Tillage, *&c.* are deducted.

THUS when an Acre brings a Crop worth *four Pounds*, and the expences thereof amount to *five Pounds*, the Owner's Loſs is *one Pound*; and when an Acre brings a Crop which yields *thirty Shillings*, and the expence amount to no more than *ten Shillings*, the Owner receives *one Pound* clear Profit from this Acre's very ſmall Crop, as the other loſes *one Pound* by his greater Crop.

THE uſual Expences of an Acre of Wheat, ſown in the *Old Husbandry*, in the Country where I live, is in ſome Places, for two Buſhels and a half of Seed; in other Places four Buſhels and a half, the leaſt of theſe Quantities at *three Shillings per* Buſhel, being the preſent Price, is *Seven Shillings* and *Sixpence*. For three Ploughings, Harrowing, and Sowing, *Sixteen Shillings*; but if plough'd four times, which is better, *one Pound*. For thirty Load of Dung, to a Statute Acre, is *two Pounds five Shillings*. For Carriage of the Dung, according to the Diſtance, from *two Shillings* to *Six-pence* the Load; *one Shilling* being the Price moſt common, is *one Pound ten Shillings*. The Price for weeding is very uncertain, it has ſometimes coſt *twelve Shillings*, ſometimes *two Shillings per* Acre.

	l.	*s.*	*d.*
In Seed and Tillage, nothing can be abated of - - - - - - - - -	01	03	06
For the Weeding, one Year with another, is more than - - - - - -	00	02	00
For the Rent of the Year's Fallow	00	10	00
For the Dung; 'tis in ſome Places a little cheaper, neither do they always lay on quite ſo much; therefore abating 15 *s.* in that Article, we may well ſet Dung and Carriage at -	02	10	00
Reaping commonly 5 *s.* ſometimes leſs	00	04	06
	04	10	00

FOLDING of Land with Sheep is reckoned abundantly cheaper than Cart-Dung; but this is to be queſtioned, becauſe much Land muſt lie ſtill for keeping a Flock (unleſs there be Downs) and for their whole Year's Keeping, with both Graſs and Hay, there are but three Months of the twelve wherein the Fold is of any conſiderable Value; this makes the Price of their Manure quadruple to what it would be, if equally good all the Year, like Cart-Dung: And Folding Sheep yield little Profit, beſides their Dung, becauſe the Wool of a Flock, except it be a large one, will ſcarce pay the Shepherd and the Shearers. But there is another Thing yet, which more inhances the Price of Sheep Dung, and that is the dunging the Land with their Bodies, when they all die of the Rot, which happens too frequently in many Places; and then the whole Crop of Corn muſt go to purchaſe another Flock, which may have the ſame Fate the enſuing Year, if the Summer prove wet: And ſo may the Farmer be ſerved for ſeveral more ſucceſſive Years, unleſs he ſhould break, and another take his Place, or that dry Summers come in Time to prevent it. To avoid this Misfortune he would be glad to purchaſe Cart-Dung at the higheſt Price, for ſupplying the Place of his Fold; but 'tis only near Cities and great Towns, that a ſufficient Quantity can be procured.

BUT, ſuppoſing the Price of Dunging to be only *two Pounds ten Shillings*, and the general Expence of an Acre of Wheat, when ſown, at *three Shillings per* Buſhels to be *four Pounds ten Shillings*, with the Year's Rent of the Fallow.

THE Expences of planting an Acre of Wheat in the *Houghing Husbandry*, is three Pecks * of Seed, at *three Shillings per* Buſhel, is *two Shillings* and *Three-pence*. The whole Tillage, if done by Horſes, would be *eight Shillings*; becauſe our two Ploughing and ſix Houghings, † are equal to two Stirrings, the common Price whereof is *four Shillings* each; but this we diminiſh half when done, by Oxen kept on *St. Foin*, in this manner, *viz.* Land, worth *thirty Shillings* Rent, drill'd with *St. Foin*, will well maintain an Ox an Year, * and ſometimes Hay will be left to pay for the Making we cannot therefore allow more than *one Shilling* a Week for his Work, becauſe his Keeping comes but to *Seven-pence* a Week round the Year.

IN plain Ploughing, ſix Foot contains eight Furrows; but we plough a Six-Foot Ridge at four Furrows, becauſe in this there are two Furrows covered in the Middle of it, and one on each Side of it lies open. Now, what we call one Houghing, is only two Furrows of this Ridge, which is equal to a fourth Part of one plain Ploughing; ſo that the Houghing of four Acres requires an equal Number of Furrows with one Acre, that is plough'd plain, and equal time to do it in (except that the Land that is kept in Houghing, works much eaſier than that which is not.)

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* Sometimes half a Buſhel is the moſt juſt Quantity of Seed to drill on an Acre.

† But we ſometimes plough our Six-Foot Ridges before Drilling, at five or ſix Furrows, which is a Furrow or two more than I have reckoned: But we do not always Hough ſix times afterwards.

* Or an Ox may be well kept nine Months, with an Acre of indifferent *Horſe-Hough'd* Turnips; and if we value them only at the Expence and Rent of the Land, this will be a yet cheaper Way of maintaining Oxen.

ALL the *Tillage* we ever beſtow upon a Crop of Wheat that follows a hough'd Crop, is equal to eight Houghings, two of which may require four Oxen each, one of them three Oxen, and the other five Houghings two Oxen each. However, allow three Oxen to each ſingle Houghing, taking them all one with another, which is three Oxen more than it comes to in the whole.

BEGIN at five in the Morning; and in about ſix Hours you may hough three Acres, being equal in Furrows to three Rood, *i. e.* three Quarters of an Acre. Then turn the Oxen to Graſs, and after reſting, eating, and drinking two Hours and a half, with another Set of Oxen begin Houghing again; and by, or before half an hour after Seven at Night, another like Quantity may be houghed. Theſe are the Hours the Statute has appointed all Labourers to work, during the Summer Half-year.

To hough theſe ſix Acres a Day, each Set of Oxen draw the Plough only eight Miles and a Quarter, which they may very well do in five Hours; and then the Holder and Driver will be at their Work of Ploughing ten Hours, and will have four Hours and a half to reſt, &c.

THE Expence then of Houghing ſix Acres in a Day, in this manner, may be accounted; at *one Shilling* the Man that holds the Plough, *Six-pence* the Boy that drives the Plough, *one Shilling* for the ſix Oxen, and *Six-pence* for keeping the Tackle in Repair. The whole Sum for Houghing theſe ſix Acres is *three Shillings*, being *Six-pence per* Acre. * †

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* But where there is not the Convenience of keeping Oxen, the hiring Price of Houghing with Horſes is one Shilling each Time.

† When a Roller is uſed, which is leſs than a Houghing, becauſe one Perſon to lead is enough, and that may be a Boy; and once in an Interval may ſuffice, and then 'tis leſs Labour than half

THEY who follow the *Old Husbandry* cannot keep Oxen ſo cheap, becauſe they can do nothing without the Fold, and Store-Sheep will ſpoil the *St. Foin.* They may almoſt as well keep Foxes and Geeſe together, as Store-Sheep and good *St. Foin.* Beſides, the ſowed *St. Foin* coſt ten times as much the Planting as drill'd *St. Foin* does, and muſt be frequently manured, or elſe it will ſoon decay; eſpecially upon all Sorts of chalkly Land, whereon 'tis moſt commonly ſown.

THE Expence of Drilling cannot be much, for as we can Hough ſix Acres a Day, at two Furrows on each Six-Foot Ridge, ſo may we drill twenty-four Acres a Day, with a Drill that plants two of thoſe Ridges at once; and this we may reckon a *Penny Half-penny* an Acre.

I HAD five Acres of Wheat weeded this Year for *Six-pence*, being the ſecond Crop: And the greateſt Part of my drill'd Wheat wants no Weeding at all; every ſucceſſive Crop being ſtill more free from Weeds than the preceding Crop; therefore I will ſet it all together at *Six-pence* * an Acre for Weeding.

FOR a Boy to follow the *Hough-Plough*, to uncover the young Wheat, when any Clods or Earth happen to fall on it, for which Trouble there is ſeldom occaſion above once to a Crop, *Two-pence* an Acre. *One Penny* is too much for Brine and Lime for an Acre.

REAPING this Wheat is not worth above half as much as the Reaping of a ſown Crop of equal Value; becauſe the Drill'd ſtanding upon about a ſixth Part of the Ground, a Reaper may cut almoſt as much of the Row at one Stroke, as he could at ſix, if the ſame ſtood diſperſed all over the Ground, as the Sowed does. And becauſe he who reaps ſowed Wheat, muſt reap the Weeds along with the Wheat; but the Drilled has no Weeds; and beſides, there

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half a Houghing; and for this we may well abate one Houghing of the eight.

* This is when the Land has been well cleanſed of Weeds in the preceding Crop, or Fallow, or both.

there goes a greater Quantity of Straw, and more Sheaves, to a Buſhel of the ſowed, than of the drilled. And ſince ſome hundred Acres of drilled Wheat has been reaped at *two Shillings* and *Six-pence per* Acre, I will count that to be the Price.

The whole EXPENCE *of an Acre of Drilled Wheat.*

	l.	*s.*	*d.*
For Seed - - - - - - - - - -	00	02	03
For Tillage - - - - - - - - - -	00	04	00
For Drilling - - - - - - - - -	00	00	06
For Weeding - - - - - - - - -	00	00	06
For Uncovering - - - - - - - -	00	00	02
For Brine and Lime - - - - - -	00	00	01
For Reaping - - - - - - - - -	00	02	06
Total	00	10	00
The Expence of an Acre of Sow'd Wheat is - - - - - - - -	04	00	00
To which muſt be added, for the Year's Rent of the Fallow - - -	00	10	00
Total	04	10	00

IF I have reckon'd the Expence of the Drilled at the loweſt Price, to bring it to an even Sum, I have alſo abated in the other more than the whole Expence of the Drilled amounts unto.

AND thus the Expence of a drilled Crop of Wheat is but the ninth Part of the Expence of a Crop ſown in the common Manner.

'TIS alſo ſome Advantage, that leſs Stock is required where no Store-Sheep are uſed.

II. *Of the different Goodneſs of a Crop.*

THE Goodneſs of a Crop conſiſts in the Quality of it, as well as the Quantity; and Wheat being the moſt uſeful Grain, a Crop of this is better than a Crop of any other Corn, and the hough'd Wheat has larger Ears (and a fuller Body) than ſow'd Wheat. We can have more of it, becauſe the ſame Land will produce it every Year, and even Land which, by the *Old Husbandry*, would not be made to bear Wheat at all: So that in many Places, the *New Husbandry* can raiſe Ten Acres of Wheat for One that the *Old* can do; becauſe where Land is poor, they ſow but a Tenth Part of it with Wheat.

WE do not pretend, that we have always greater Crops, or ſo great as ſome ſown Crops are, eſpecially if thoſe mention'd by Mr. *Houghton*, be not miſtaken.

THE greateſt Produce I ever had from a ſingle Yard in Length of a double Row, was Eighteen Ounces; the Partitions of this being Six Inches, and the Interval Thirty Inches, was, by Computation, Ten Quarters (or Eighty Buſhels) to an Acre.

I HAD alſo Twenty Ounces to a like Yard of a Third ſucceſſive Crop of Wheat; but this being a treble Row, and the Partitions and Interval being wider, and ſuppoſed to be in all Six Foot (though not quite ſo much) was computed to Six Quarters to an Acre. And if theſe Rows had been better order'd than they were, and the Earth more pulveriz'd, more Stalks would have Tillered out, and more Ears would have attain'd their full Size, and have equal'd the beſt, which muſt have made a much greater Crop than either of theſe were

BUT to compare the different Profit, we may proceed thus: The Rent and Expence of a drill'd Acre being *one Pound*, and of a ſow'd Acre *five Pounds*; One Quarter of Corn produced by the Drill'd, bears an equal Proportion in Profit to the *one Pound*, as Five Quarters produced by the other do to the *five Pounds*. As ſuppoſe it be of Wheat, at *two Shillings* and *Six-pence* a Buſhel, there is neither Gain nor Loſs in the one nor the other Acre, though the former yield but One Quarter, and the other, Five; but if the drill'd Acre yield Two Quarters, and the ſow'd Acre Four Quarters at the ſame Price, the drill'd brings the Farmer *one Pound* clear Profit, and the ſown, by its Four Quarters, brings the other *one Pound* Loſs. Likewiſe, Suppoſe the Drilling Farmer to have his *five Pounds* laid out on Five Acres of Wheat, and the other to have his *five Pounds* laid out on One dung'd Acre, then let the Wheat they produce be at what Price it will, if the Five Acres have an equal Crop to the One Acre, then the Gain or Loſs muſt be equal. But when Wheat is *Cheap*, as we ſay it is, when Sold at *Two and Six-pence* a Buſhel, then if the *Virgilian* has Five Quarters on his Acre, he muſt ſell it all to pay his Rent and Expence; but the other haveing Five Quarters on each of his Five Acres, the Crop of One of them will pay the Rent and Expence of all his Five Acres *, and he may keep the remaining Twenty Quarters, till he can ſell them at *five Shillings* a Buſhel, which amounts to *forty Pounds*, wherewith he may be able to buy four of his five Acres at twenty Years Purchaſe, out of one Year's Crop, whilſt the *Virgilian* Farmer muſt be content to have only his Labour for his Travel; or if he pretends to keep his Wheat till he ſells it at *five Shillings* a Buſhel, he commonly runs in Debt to his Neighbours, and in Arrear of his Rent; and if the Markets do not riſe in time, or if his Crops fail in the Interim, his Landlord ſeizes on his Stock, and then he knows not how it may be ſold, Actions are brought againſt him, the Baliffs and Attornies pull him to Pieces; and then our *Virgilian* Farmer is broke †.

III *The Certainty of a Crop.*

THE Certainty of a Crop is much to be regarded, it being better to be ſecure of a moderate Crop, than to have but a mere Hazard of a great one. The *Virgilian*

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* Or ſuppoſe a drill'd Acre to produce no more than one Third of the ſow'd Acre's Crop, whoſe Expence is five times as much as of the drill'd, 'tis much more profitable, becauſe a Third of Five Pounds, is One Pound Thirteen and Four-pence; and a Fifth of the Rent and Expence being only One Pound, ſuch drill'd Acre pays the Owner Thirteen Shillings and Four-pence more Profit than the other which brings a Crop treble to the drill'd.

† Tho' only five Acres and one Acre be put, yet we may imagine them Two hundred and fifty, and Fifty to inrich the one, or break the other Farmer.

gilian is often deceiv'd in his Expectation, when his Crop at coming into Ear, is very big, as well as when 'tis in Danger of being too little. Our Houghing Farmer is much leſs liable to the Hazard of either of thoſe Extreams; for when his Wheat is big, 'tis not apt to lodge or fall down, which Accident is uſually the utter Ruin of the other, he is free from the Cauſes which make the *Virgilian* Crop too little.

A VERY effectual Means to prevent the failing
of a Crop of Wheat, is to plough the pulve-
1. riz'd Earth for Seed early, and when 'tis dry. The
early Seaſon alſo is more likely to be dry than the
latter Seaſon is. The *Virgilian* is commonly late
in his Sowing; becauſe he can't Fallow his Ground
early, for fear of killing the Couch, and other Graſs
2. that maintains his folding Sheep, which are ſo ne-
ceſſary to his Husbandry: And when 'tis ſow'd
late, it muſt not be ſow'd dry, for then the Winter
might kill the young Wheat. Neither can he at
that time plough dry, and ſow wet, becauſe he
3. commonly ſows under Furrows; that is, ſows the
Seed firſt, and ploughs it in as faſt as 'tis ſown. If
he ſows early (as he may if he will) in light Land,
4. he muſt not ſow dry, for fear the Poppies and o-
ther Weeds ſhould grow and devour his Crop; and
if his Land be ſtrong, let it be ſown early, wet or
5. dry (tho' wet is worſt) 'tis apt to grow ſo ſtale
and hard by the Spring, that his Crop is in danger
of Starving, unleſs the Land be very rich, or much
dung'd, and then the Winter and Spring proving
kind, it may not be in leſs danger of being ſo big
as to fall down and be ſpoil'd. Another thing is,
that though he had no other Impediment againſt
6. ploughing dry, and ſowing wet, 'tis ſeldom that he
has time to do it in; for he muſt plough all his
Ground, which is eight Furrows in ſix Foot, and
whilſt it is wet, muſt lie ſtill with his *Plough*.
7. When he ſows under Furrow, he fears to plough
deep, leſt he bury too much of his Seed, and if he
8. ploughs ſhallow, his Crop loſes the Benefit of deep
ploughing,

ploughing, which is very great. When he ſows
upon Furrow (that is after 'tis plough'd he muſt
9. harrow the Ground level to cover the Seed, and
that expoſes the Wheat the more to the cold
Winds, and ſuffers the Snow to be blown off it,
and the Water to lie longer on it; all which are
great Injuries to it.

OUR *Houghing Husbandry* is different in all of the forementiond Particulars.

1. WE can plough the two Furrows whereon the next Crop is to ſtand, either before the preſent Crop is reap'd, or immediately after 'tis off.

2. WE have no uſe of the Fold; becauſe our Ground has annually a Crop growing on it, and it muſt lie ſtill a Year, if we would fold it, and that Crop would be loſt; and all the Good the Fold could do to the Land, would be only to help to pulverize it for one ſingle Crop; its Benefit not laſting to the ſecond Year. And ſo we ſhould be certain of loſing one Crop for the very uncertain Hopes of procuring one the enſuing Year by the Fold; when 'tis manifeſt by the adjoining Crops, that we can have a much better Crop every Year, without a Fold on any other Manure.

3. WE can plough dry, and drill wet, without any manner of Inconvenience. He fears the Weeds will
grow and deſtroy his Crop: We hope they will
4. grow, to the end we may deſtroy them.

5. WE do not fear to plant our Wheat early (ſo that we plough dry) becauſe we can help the Hardneſs or Staleneſs of the Land by Houghing.

6. THE two Furrows of every Ridge whereon the Rows are to be drill'd, we plough dry; and if the Weather prove wet before theſe are all finiſh'd we can plough the other two Furrows up to them. until it be dry enough to return to our Ploughing the firſt two Furrows, and after finiſhing them, let the Weather be wet or dry, we can plough the laſt two Furrows. We can plough our two Furrows in the fourth part of the Time they can plough their

eight, which they muſt plough dry all of them, in every ſix Foot; for they can't plough part dry, and the reſt when 'tis wet, as we can.

7. We never plant our Seed under Furrow, but place it juſt at the Depth, which we judge moſt proper, and that is pretty ſhallow, about two Inches deep, and then there is no danger of burying it.

8. We not only plough a deep Furrow, but alſo plough to the Depth of two Furrows; that is, we Trench-Plough where the Land will allow it; and we have the greateſt Convenience imaginable for doing this, becauſe there are two of our four Furrows always lying open; and two plough'd Furrows (that is one plough'd under another) are as much more advantageous for the nouriſhing a Crop, as two Buſhels of Oats are better than one for nouriſhing a Horſe. Or if the Staple of the Land be too thin or ſhallow, we can help it by raiſing the Ridges prepar'd for the Rows the higher above the Level.

9. We alſo raiſe a high Ridge in the Middle of each Interval above the Wheat before Winter, to protect it from the cold Winds, and to prevent the Snow from being driven away by them. And the Furrows or Trenches, from whence the Earth of theſe Ridges is taken, ſerve to drain off the Water from the Wheat, ſo that it being dryer, it muſt be warmer than the harrow'd Wheat, which has neither Furrows to keep it dry, nor Ridges to ſhelter it, as every Row of ours has on both Sides of it.

IV. *The Condition in which the Land is left after a Crop.*

The different Condition the Land is left in after a Crop, by the one and the other *Husbandry*, is not leſs conſiderable than the different Profit of the Crop.

A Piece of eleven Acres of a poor thin chalky Hill, was ſown with Barley in the common Manner, after a hough'd Crop of Wheat, and produced full five Quarters and a half to each Acre (reckoning the Tythe) which was much more than any Land in all the Neighbourhood yielded the ſame Year; tho' ſome of it be ſo rich, as that one Acre is worth three Acres of this Land: And no Man living can remember that ever this produced above half ſuch a Crop before, even when the beſt of the common Management has been beſtow'd upon it.

A Field that is a ſort of a Heath Ground, us'd to bring ſuch poor Crops of Corn, that heretofore the Parſon carry'd away a whole Crop of Oats from it, believing it had been only his Tythe. The beſt Management that ever they did or could beſtow upon it, was to let it reſt two or three Years, and then fallow and dung it, and ſow it with Wheat, next to that with Barley and Clover, and then let it reſt again; but I cannot hear of any good Crop that ever it produced by this or any other of their Methods; 'twas ſtill reckon'd ſo poor, that no body cared to rent it. They ſaid Dung and Labour were thrown away upon it; then immediately after two Crops of black Oats had been taken off it, the laſt of which was ſcarce worth the Mowing, the Clover always look'd yellow, and ſo does the Graſs that grows all round the Field.

Three houghed Crops were taken from it, and then being ſown with Barley, it brought a very good Crop, much better than ever it was known to yield before; and then a good Crop of houghed Wheat ſucceeded the Barley, being drilled upon one plain Ploughing, immediately after the Barley was taken off; and then it was again ſown with Barley, and upon the Wheat Stubble; and that alſo was better than the Barley uſed to be after a dung'd Crop of Wheat.

Now, all the Farmers of the Neighbourhood affirm, that it is impoſſible but that this muſt be very rich Ground, becauſe they have ſeen it produce ſix Crops in ſix Years, without Dung or Fallows, and never a one of them fail. But, alaſs! this different Reputation they give to the Land, does not at all belong to it, but to the different Sorts of *Husbandry*; for the Nature of it cannot be alter'd but by that, the Crops being all carried off it, and nothing added to ſupply the Subſtance thoſe Crops take from it, except (what

Mr. *Evelyn* calls) the Cœleſtial Influences, and that theſe are received by the Earth, in Proportion to the Degrees of its Pulveration.

A FIELD was Drilled with Barley after a houghed Crop, and another adjoining to it on the ſame Side of the ſame poor Hill, and exactly the ſame Sort of Land, was drilled with Barley alſo, Part of it after the ſown Crop, the ſame Day with the other; there was only this Difference in the Soil, that the former of theſe had no manner of Compoſt on it for many Years before, and the latter was dunged the Year before, yet its Crop is not near ſo good as that which followed the houghed Crop; though the latter had twice the Ploughing that the former had before Drilling, and the ſame Houghings afterwards, *viz.* Each was houghed three times.

A FIELD of about ſeventeen Acres was Summer fallowed, and drilled with Wheat, and with the Houghing, brought a very good Crop (except Part of it, which being eaten by treſpaſſing Sheep in the Winter, was ſomewhat blighted;) the *Michaelmas* after that was taken off, the ſame Field was drilled again with Wheat, upon the Stubble of the former, and houghed but twice in all: This ſecond Crop was a good one, ſcarce any in the Neighbourhood better. A Piece of Wheat adjoining to it, on the very ſame Sort of Land (except that this latter was always reckoned better, being thicker in Mould above the Chalk) ſown at the ſame time on dung'd Fallows, and the Ground always dunged once in three Years, yet this Crop fail'd ſo much, as to be judged, by ſome Farmers, not to exceed the Tythe of the other: That the houghed Field has received no Dung or Manure for many Years paſt, it lying out of Reach for carrying of Cart-Dung, and no Fold being kept on my Farm: But I cannot ſay, I think, there was quite ſo much Odds betwixt this ſecond undung'd houghed Crop and the ſown; yet this is certain, that the former is a good, and the latter a very bad Crop.

I COULD give many more Inſtances of the ſame

Kind, where houghed Crops and ſown Crops have ſucceeded better after houghed Crops than after ſown Crops, and never yet have ſeen the contrary; and therefore am convinced, that the Houghing (if it be duly performed, enriches the Soil more than Dung and Fallows, and leaves the Land in a much better Condition for a ſucceeding Crop; the Reaſon I take to be very obvious. The artificial Paſture of Plants is made and increaſed by Pulveration only; and nothing elſe there is in our Power to enrich our Ground, but to pulverize it, and keep it from being exhauſted by *Vegetables*. * (Superinductions of Earth are an Addition of more Ground, or changing it, and is more properly Purchaſing than Cultivating.)

Their one Year's *Tillage*, which is but two Ploughings before Seed-time, commonly makes but little Duſt, and that which it does make, has but a ſhort time to lie expoſed for Impregnation; and after the Wheat is ſown the Land lies unmoved for near twelve Months, all the while gradually loſing its Paſture, by ſubſiding, and by being continually exhauſted in feeding a treble Stock of Wheat Plants, and a Stock of Weeds, which are ſometimes a greater Stock. This puts the *Virgilians* upon a Neceſſity of uſing of Dung, which is, at beſt, but a *Succedaneum* of the Hough; for it depends chiefly on the Weather, and other Accidents, whether it may prove ſufficient by Fermentation to pulverize in the Spring, or no: And, 'tis a

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* It may be asked, How 'tis poſſible that eight Houghings, which are but equal, in Labour, to two plain Ploughings, ſhould ſo much exceed three plain Ploughings, as to procure as good or a better Crop without Manure, than the common three Ploughings can do with Manure, and enrich the Land alſo?

The Anſwer is, That each Houghing of the Five or Six being done to the Wheat Plants, though it does not clean plough the whole Interval underneath, yet it changeth the whole external Superficies (or Surface) thereof, whereby it becomes impregnate by the nitrous Air, as much as if it were all clean ploughed at the time of every Houghing, and the Weeds are as much ſtifled, or ſuffocated.

Queſtion whether it will equal two additional* Houghings, or but one; though, as I have computed it, one Dunging coſts the Price of one hundred Houghings.

'TIS poſſible, perhaps, to pulverize the Ground with a Pen, and they ſeem to act almoſt as oddly, when, at ſuch a vaſt Expence, inſtead of a Hough, they make Uſe of a T——, to help them in their Pulveration.

WHEN they have done all they can, the Paſture, they raiſe, is generally too little for the Stock that is to be maintained upon it, and much the greateſt Part of the Wheat Plants are ſtarved; for from twenty Gallons of Seed they ſow on an Acre, they receive commonly no more than twenty Buſhels of Wheat in their Crop, which is but an Increaſe of eight Grains for one: Now, conſidering how many Grains there are in one good Ear, and how many Ears on one Plant, we find, that there is not one Plant in ten that lives till Harveſt, even when there has not been Froſt in the Winter ſufficient to kill any of them; or if we count the Number of Plants that come up on a certain Meaſure of Ground, and count them again in the Spring, and likewiſe at Harveſt, we ſhall be ſatisfied, that moſt, or all of the Plants that are miſſing could die by no other Accident than want of Nouriſhment.

THEY are obliged to ſow this great Quantity of Seed, to the End that the Wheat, by the great Number of Plants, may be the better able to contend with the Weeds; and yet, too often at Harveſt, we ſee a great Crop of Weeds, and very little Wheat among them. Therefore, this Paſture being inſufficient to maintain the preſent Crop, without ſtarving the greateſt Part of its Plants, is likely to be leſs able to maintain a ſubſequent Crop, than that Paſture which is not ſo much exhauſted.

WHEN their Crop of Wheat is much leſs than ours, their Vacancies (if computed all together) may be greater than thoſe of our Partitions and Intervals; theirs, by being irregular, ſerve chiefly for the Protection of Weeds; for they cannot be ploughed out, without deſtroying the Corn, any more than Cannons Firing at a Breach, whereon both Sides are contending, can kill Enemies, and not Friends.

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* *Additional*, becauſe there muſt firſt be ſeveral Houghings to make our treble Row equal to an undunged Six-Foot Ridge of *ſown* Wheat.

Their Plants ſtand on the Ground in a confuſed Manner, like a Rabble; ours like a diſciplined Army; we make the moſt of our Ground; for we can if we pleaſe, cleanſe the Partitions with a Hand-Hough;* and for the reſt, if the Soil be deep enough to be drilled on the Level, in treble Rows, the Partitions at ſix Inches, † the Intervals five Foot; five Parts in ſix of the whole Field may be pulverized every Year, and at proper times all round the Year.

The Partitions being one ſixth Part for the Crop to ſtand on, and to be nouriſhed by in the Winter, one other ſixth Part being well pulverized, may be ſufficient to nouriſh it from thence till Harveſt; the Remainder, being two Thirds of the whole, may be kept unexhauſted, the one Third for one Year, and the other Third of it two Years, all kept open for the Reception of the Benefits deſcending from above, during ſo long a time; whilſt the ſowed Land is ſhut againſt them, every Summer, except the little time in which it is Fallow'd, once in three Years, and a little, perhaps, whilſt they plough it for the Barley in the Winter, which is a Seaſon ſeldom proper for pulverizing the Ground.

Their Land muſt have been exhauſted as well by thoſe ſupernumery Plants of Wheat, while they lived, as by thoſe that remain for the Crop, and by the Weeds. Our land muſt be much leſs exhauſted, when it has never above one third Part of the Wheat-Plants to nouriſh that they have, and generally no Weeds, ſo that our houghed Land having much more Vegetable Paſture made, and continually renewed, to ſo much a leſs Stock of Plants, [*] muſt needs be left, by every Crop in a much better Condition than theirs is left in by any one of their ſown Crops, although our Crops of Corn at Harveſt be better than theirs. [†]

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* Of all annual Weeds.

† But when 'tis drilled upon Ridges, the Proportion is leſs by how much the Partitions being thicker in Mould, contain more than a ſixth Part of the whole ſix Foot of Earth, and the Proportion of unexhauſted Earth will be alter'd likewiſe; and I only mention theſe Diſtances to avoid Fractions.

THEY object againſt us, ſaying, That ſometimes the Houghing makes Wheat too ſtrong and groſs, whereby it becomes the more liable to the Blacks (or Blight of Inſects); but this is the Fault of the Hougher, for he may chuſe whether he will make it too ſtrong, becauſe he may apply his Houghings at proper times only, and apportion the Nouriſhment to the Number and Bulk of his Plants. However, by this Objection they allow, that the Hough can give Nouriſhment enough, and therefore they cannot maintain that there is a Neceſſity of Dung * in the *Houghing Husbandry*; and that, if our Crops of Wheat ſhould happen to ſuffer by being too ſtrong, our Loſs will be leſs than theirs, when that is too ſtrong, ſince it will coſt them nine times our Expence to make it ſo.

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[*] Therefore, whenever a Soil receives more Supplies of fine Earth from the Atmoſphere, than is exhauſted by all the Plants that grow in the Soil, it becomes richer; but if the contrary, then it becomes poorer.

[†] On an undung'd ſix Foot Ridge, we have three Rows, eight Inches aſunder, all which being equal, during the Winter but each of the two outſide Rows at Harveſt producing ten times as much Wheat as the middle Row doth, all three together produce a Quantity equal to one and twenty of this middle Row. Now, ſuppoſing the Roots of this Row not to reach through the outſide Rows, ſo as to receive any Benefit from the houghed Intervals, then this Row might only be equal to one of nine Rows, which ſhould have been drilled eight Inches aſunder on this Ridge, and then our three would only be equal to twenty one of ſuch nine Rows. But ſince it can be demonſtrated, that the Roots of our middle Row do paſs through both the outſide Rows far into the houghed Intervals, we may well ſuppoſe it to be at leaſt double to what it would have been if it had had no Benefit from the Houghing, and then our three will be equal to forty two of ſuch nine unhoughed Rows. Thus our Crop is thirty three, in forty two (or almoſt four Parts in five) increaſed by the Houghing; for though many Fields of Wheat have been drilled all over in Rows eight Inches aſunder, it never has been judged in twenty Years Experience, that a Crop ſo planted, though not houghed, was by its Evenneſs and Regularity, leſs, *Cæteris, Paribus*, than a Crop ſown at random.

A ſecond Objection is, that as Houghing makes poor Land become rich enough to bear good Crops of Wheat for ſeveral Years ſucceſſively, the ſame muſt needs make very good Land become too rich for Wheat. I anſwer, That if poſſibly it ſhould ſo happen, there are two Remedies to be uſed in ſuch a Caſe; the one is to plant it with Beans, or ſome other *Vegetables*, which cannot be over-nouriſhed, as Turnips, Carrots, Cabbages, and ſuch like, which are excellent Food for fatting of Cattle; or elſe they may make Uſe of the other infallible Remedy, when that rich Land, by producing Crops every Year in the *Houghing-Husbandry*, is grown too vigorous and reſty, they may ſoon take down its Mettle, by Sowing it a few Years in their *Old Husbandry*, which will fill it again with a new Stock of Weeds, that will ſuck it out of Heart, and exhauſt more of its Vigour, than the Dung, that helps to produce them, can reſtore.

THERE is a third Objection, and that is, that the Benefit of ſome Ground is loſt where the *Hough-Plough* turns at each end of the Lands; but this cannot be much, if any, Damage; becauſe, about four ſquare

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* As for the Quantity of Vegetable Matter of Dung, when reduced to Earth by Putrifaction, it is very inconſiderable, and, of many Sorts of Manure, next to nothing.

The almoſt only Uſe of all Manure, is the ſame as of *Tillage*, *viz.* the Pulveration it makes by Fermentation, as *Tillage* doth by Attrition or Contuſion; and with theſe Differences, that Dung, which is the moſt common Manure, is apt to increaſe Weeds, as *Tillage* (of which **Houghing** is chief) deſtroys them, and Manure is ſcanty in moſt Places, but *Tillage* may be had every where. Another Difference is, the vaſt Diſproportion of the Price of Manure and that of *Tillage*.

Note. As we have no Way to enrich the Soil, but by Pulveration of Manure, or of Inſtruments, or of both; ſo Nature has ordain'd, that the Soil ſhall be exhauſted by nothing, but by the Roots of Plants.

Perch to a Statute Acre, is ſufficient for this Purpoſe, and that, at the Rate of *ten Shillings* Rent, comes to but *Three-pence*, though this varies, according as the Piece is longer or ſhorter; and ſuppoſing the moſt to be eight Perch, that is but *Six-pence per* Acre; and that is not loſt neither, for whether it be of natural or artificial Graſs, the *Hough-Plough* in turning on it, will ſcratch it, and leave ſome Earth on it, which will enrich it ſo much, that it may be worth its Rent for Baiting of Horſes or Oxen upon it. And beſides, theſe Ends are commonly near Quick-Hedges or Trees, which do ſo exhauſt it, that when no Cattle come there to manure it, 'tis not worth the Labour of Ploughing it.

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